

## HORTICULTURAL ABSTRACTS.

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## Horticultural Abstracts

Vol. IX

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No. 1

## MISCELLANEOUS.

## Growth promoting substances.\*

1. SÖDING, H. 577.15.04  
 Die Wuchsstofftheorie in der angewandten Botanik. (The theory of growth substances in applied botany.)  
*Angew. Bot.*, 1938, 20 : 407-11, bibl. 19.

Plant hormones are known to be all important for plant growth. It has lately been shown that a whole series of chemical compounds which are more easily obtained has the same effect, the most important being  $\beta$ -indoleacetic acid or heteroauxin, indole-3-butyric acid and  $\alpha$ -naphthalene acetic acid. These are best applied as the K or Na salt in water solution or paste. One of the interesting indications given by investigation on the effect of these products is that the so-called root growth substance is not the only hormone necessary to induce rooting. Yeast extract can also help rooting, possibly by means of the biotin in it. It would appear that no attempt as yet has been made to discover whether the further addition of yeast extract would induce rooting in those cuttings to which other growth substances have been applied in vain. Experiments on this point would be very valuable. It may be noted that the effect of yeast extract may not be due entirely to biotin and also that there are different strains of yeasts all of which should be tried. Growth substances have been used not only to induce rooting in cuttings, but for other purposes also. Thus a certain amount of success has attended their use in grafting, e.g. Müller-Stoll successfully treated vine grafts with 0.05% heteroauxin solution. Amlong and Naundorf have used them to induce early growth in lilac. Again Shibuya broke the dormancy in groundnut seed by applying growth substance to the wounded radicle and Amlong and Naundorf have induced increased germination capacity and strength in old stored seed or seed reluctant to germinate by immersion for 24 hours in 0.01 or 0.001 N heteroauxin solution. The most surprising feature in this last experiment was that the plants which developed from the treated seed grew larger and more strongly than the controls. This also happened in the case of fresh seed. The differences were large, thus treated radish seed yielded nearly double and treated sugar beet seed yielded over double crops. Thimann and Lane report comparable results with wheat and oats. The primary effect is on the vegetative growth. It seems to be similar to that obtained by transplanting cereals even as regards the initial check noticeable in both cases. On the whole, however, seed treatment needs further investigation as it has not been uniformly successful. A further method of application to the young plant is by spraying or painting on with a fine brush. Or again mere watering with weak solution has been found to increase growth, e.g. as in *Matthiola*. The effect on the actual seed crop has not been determined. Growth substances have been successfully used to induce parthenocarpic fruiting in *Ilex opaca*. Finally Traub has observed that treatment of unripe fruits with weak solutions of growth substance increases their storage life, but that the use of stronger solutions decreases it.

\* See also 45.

2. SÖDING, H. 577.15.04  
 Wuchsstoffbildung und Wuchsstoffverteilung in der Kompositenstaude *Heliopsis laevis* im Laufe einer Vegetationsperiode. (The formation and distribution of growth substance in *Heliopsis laevis* during a growing period.)  
*Flora, Jena*, 1938, (N.F.) 32 : 425-46, bibl. 18.  
 The distribution of growth substance in shoots of *Heliopsis laevis* was determined by the agar diffusion method throughout one growing season. The chief foci are strongly growing leaf buds in the first instance, followed by blossom buds and young leaves; open flowers and especially young fruitlets yield very much less growth substance to the rest of the plant, although they themselves apparently possess it in abundance. The growth substance moves in the plant from its place of origin in a direction away from the poles. So long as the stems are still quite small they produce growth substance abundantly throughout their length. As they grow its production sinks at the basal end. About the end of June production rises again probably in connexion with the strong secondary growth thickening in the shoot. The maximum concentration is at first found just beneath the growing point, but in flowering plants it is lower, though still in the upper half of the stem. From August onwards growth substance production decreases. In old sections of stem two growth substance streams are on the move, one in the cambium, the other at the junction of xylem and phloem, probably in the outer living phloem cells. The inmost phloem and the xylem appear to contain no growth substance; the bark contains little or none. A plant does not yield up all its growth substance to agar; frequently the only way to detect it in this way is to use short pieces cut to about 1 cm. in length. Longer pieces yield up their growth substances much less readily on agar.

3. AMLONG, H. U., AND NAUNDORF, G. 577.15.04  
 Neue Wege der Pflanzenstimulation. (New methods of plant stimulation.)  
*Forschungsdienst*, 1938, 5 : 292-303, bibl. 10.  
 The aims of the experiments described here were to discover whether the effect of growth substances can be increased by the simultaneous application of similar stimulants, whether the effect can be increased by the addition of several chemically different growth hormones at the same time, and finally it was hoped to examine the growth substances responsible for cell division. The authors summarize their more important results as follows:—1. Treatment by soaking in heteroauxin solution for 24 hours increases not only the germinating capacity but also the germinating power of badly germinating seed. 2. The soaking of sugar beet seed prior to sowing in 0.01 N heteroauxin solution for 24 hours resulted in a 157% increase in the weight of the crop, 129% leaf increase and 123% increase in absolute sugar. 3. The treatment of seed potatoes with growth substances had practically no effect on the yield. 4. If lemon and vine cuttings had incisions made into the rind before treatment with growth substances they produced roots in greater number and more rapidly than those not incised. 5. The addition of yeast,  $Mg(NO_3)_2$  and  $MnCl_2$  to heteroauxin resulted in increased root formation in *Tradescantia*.  
 6. A combined solution of  $\frac{N}{2000}$  heteroauxin and  $\frac{N}{2000}$   $\alpha$ -naphthaleneacetic acid produced a greater number of roots in *Tradescantia* than either of the components by itself at a strength of  $\frac{N}{1000}$ .  
 7. The most effective mixture for inducing root formation in *Tradescantia* was  $\frac{N}{2000}$  heteroauxin +  $\frac{N}{2000}$   $\alpha$ -naphthaleneacetic acid + 0.02% Faex med. + 0.02%  $Mg(NO_3)_2$  + 0.02%  $MnCl_2$ . 8. The pure growth substances studied in  $\frac{N}{1000}$  concentrations can be arranged in the following descending order of effect on root formation in *Tradescantia*:  $\beta$ -indolylbutyric acid > heteroauxin >  $\alpha$ -naphthaleneacetic acid >  $\beta$ -naphthaleneacetic acid. 9. The germinating capacity of 12 poorly germinating seed types was increased by soaking for 24 hours in  $\frac{N}{1000}$  solutions on the average as

follows:—by 106% in  $\beta$ -indolylbutyric acid, by 89% in  $\alpha$ -naphthaleneacetic acid and by 85% in heteroauxin. 10. Mixed solutions as also the addition of yeast and chemical salts gave only in a very few instances better results than pure growth substances. 11. An attempt is made to form a theory to fit the results.

4. AMLONG, H. U., AND NAUNDORF, G. 577.15.04

Über die Bedeutung der Wuchsstoffe für das Frühreiben. (Growth substances as affecting early growth initiation.)

*Gartenbauwiss.*, 1938, 12: 116-20, bibl. 11.

The authors summarize their experiments as follows:—“Coating the terminal dormant buds of lilac, var. Charles X, once a day for seven days in succession with  $\frac{1}{100}$ — $\frac{1}{1000}$  N heteroauxin solution, with  $\frac{1}{1000}$  N  $\alpha$ -naphthaleneacetic acid solution, with  $\frac{1}{1000}$  N  $\beta$ -indolylbutyric acid solution or with certain other stimulating mixtures results in a considerably earlier bloom. Covering the terminal buds with growth substance pastes has a similar effect. The forcing power of a hot water bath can be increased by spraying the treated plant with heteroauxin solution once a day for a week.”

5. EVENARI, M. AND KONIS, E. 577.15.04

The effect of hetero-auxin on root formation by cuttings and on grafting. Part I.

*Palestine J. Bot. (J(erusalem) Ser.)*, 1938, 1: 13-26, Part II. *Ibidem*, 1: 113-8.

In Part I an account is given of the effects of treating dormant cuttings of olive, fig, certain rosaceous species, and vines with  $\beta$ -indolyl-acetic acid. The substance was applied in the form of a solution in which the cuttings were stood, or as lanolin pastes, or by the insertion of crystals into the base of the shoots. The effectiveness of the treatments in inducing root formation is shown to depend on their method of application. It is essential that any dose given in sufficient amount to stimulate root formation shall not excessively inhibit bud development and for this reason application at the basal end of the cuttings is preferred. Treatment of whip grafts of vine on the cut stock shortened the time required for a good union, and callus formation was increased. Similar stimulation was not, however, obtained with head grafts.

In Part II it is shown that for the treatment of leafy cuttings with  $\beta$ -indolylacetic acid the solution method is superior to the application of lanolin pastes, as the lanolin, when applied to the base of the cutting, hinders the uptake of water with consequent wilting. In certain cases a better rooting response was obtained by the addition of sugar to the growth substance solution.

H.L.P.

6. BLATNÝ, C., AND ROBEK, A. 633.791 : 577.15.04

Vliv moření methylenovou modří na růst sazeček chmelových. (Influence of methylene blue on hop cuttings.) [German summary.]

*Ann. Acad. tchécosl. Agric.*, 1937, 12: 583-90.

The application of 1:1000 solution of bacteriological methylene blue, tetramethylthionin-chloride, free of zinc, for 30 minutes, stimulated the formation of roots and general growth of *Humulus Lupulus* cuttings. The treated cuttings had 4 times longer roots and formed up to 31% greater substance than the controls.

J.S.

7. CHAILAKHYAN, M.KH. 577.15.04

Hormonal theory of plant development. [Russian.]

*Bull. Acad. Sci. U.R.S.S.*, 1937, pp. 198.

Results of numerous, chiefly photoperiodic, experiments carried out at the Timirjazev Institute of Plant Physiology, Academy of Sciences, Moscow, with many plants including several horticultural varieties such as *Chrysanthemum indicum*, *Prunus persica*, *Diospyros Kaki*, *Citrus*

*sinensis*, *Poncirus trifoliata*, lupin, sunflower, etc., led the author to his theory, which may be shortly summarized as follows:—Prior to flowering a special flowering hormone called florigen is produced by the leaves. Long-day plants produce this hormone only under long-day or permanent light conditions, short-day plants only under short-day conditions and day-neutral plants under short- and long-day conditions. Grafting fertile short-day scions on long-day stocks and *vice versa* proved that the flowering hormone is identical for all plants. The hypothetical florigen differs physiologically from growth substances or auxins. Whereas the latter are transported basipetally, florigen moves in all directions. Auxin content of plants increases with length of day regardless of their photoperiodicity, while florigen is formed only under certain conditions of photoperiodicity. In some plants the development of florigen depends also on temperature or vernalization. The bulletin is divided into 12 chapters dealing, after a general introduction (1), with sexual development (2), rôle of leaves (3), specificity of sexual development (4), and its physiological basis (5), formation (6), and transport of florigen (7), movement of florigen from one plant to another when transplanting (8), conditions of its formation (9), accumulation of florigen in leaves (10), florigen as sexual hormone of plants (11), conclusions (12). In this last chapter the practical application of the hormone theory in plant production is explained. By vernalization, photoperiodicity, transplanting and girdling, the concentration of the flowering hormone may be controlled and the flowering thus either forced or retarded, which is especially important in horticulture. About 300 references to literature are cited.

J.S.

8. CHAILAKHYAN, M.KH. 577.15.04 : 631.542.24  
**Movement of blossom hormone in girdled and grafted plants.** [Russian.]  
*C.R. Acad. Sci. U.R.S.S.*, 1938, **18** : 607-12, bibl. 10.

To study the movement of the flowering hormone florigen, seedlings of *Perilla nankinensis*, a short-day plant, were grown in permanent light from 17 March until 25 April and then until 2nd and 3rd July under natural long-day conditions. At this date the vegetatively growing plants were decapitated and divided into 2 groups. In group 1 the upper leaves were removed, 2 upper shoots being left as indicators, and 6 to 8 lower leaves as sources of florigen. In group 2 the indicator branches were left on the lower part and 6 to 8 leaves on the top. In both groups some plants were left intact, on some the stem was incised through the bark on one side and some were ringed. After this the 6 to 8 leaves supposed to produce florigen received short 10-hour-day conditions, while the shoot-indicators remained under long-day conditions. Similarly prepared plants under long-day conditions served as controls. All plants receiving the 10-hour-day on the 6 to 8 leaves, except those ringed, formed buds and flowers nearly at the same time. Control plants under long-day conditions and the ringed plants grew vegetatively. Thus it has been proved that the flowering hormone florigen both ascends and descends the stem in the bark and moves even laterally, seeing that the indicator branch over or under the lateral incision flowered simultaneously with the others. Grafting was also done with long-day, vegetative, scions on blossoming stocks and *vice versa* as also with flower-ripe or florigen-producing leaves in vegetative long-day plants. The results show that florigen passes through the union, that one pair of flower-ripe leaves produces enough of the hormone to change a vegetative plant into a flowering one. After grafting, the leaves on the fertile component should be left and the growing points removed, while on the vegetative component the leaves should be removed and the growing points left. It is supposed that the rhythm determined thus on an annual is valid also for perennials, and the importance of this fact for horticulture is stressed.

J.S.

9. CHAILAKHYAN, M.KH., and ZHDANOVA, L. R. 577.15.04 : 581.143.26.03  
**The rôle of growth hormones in form-building processes. II. Vernalization and formation of growth hormones.** [Russian.]  
*C.R. Acad. Sci. U.R.S.S.*, 1938, **19** : 219-24.

Against Cholodny's suggestion that during vernalization an accumulation of growth hormones takes place and that this higher concentration of hormones leads to the acceleration of vernalized

plants, it has been found that the content of growth hormones in completely vernalized seeds of cereals, 1 variety semi-winter oat, 1 variety winter wheat and 1 variety spring wheat, is lower than in the controls. At the same time the coleoptiles of vernalized cereals are shorter than those of the controls. This proves that the part played by the growth hormones in vernalization is restricted to the processes of plant growth and does not account for the general acceleration of development of vernalized plants.

J.S.

10. CHAILAKHYAN, M.KH., AND ZHDANOVA, L. R. 577.15.04 : 581.143  
**The rôle of growth hormones in form-building processes. III. Effect of heteroauxin treatment of seeds upon growth and development of plants.**  
 [Russian.]

*C.R. Acad. Sci. U.R.S.S., 1938, 19 : 303-6.*

Seeds of different crops, summer and winter wheat, oat, millet, vetch, hemp, white mustard, perilla, flax and peas, soaked for 24 hours in solutions containing 10, 25 and 50 milligrams of heteroauxin per 100 cc. water produced plants which ripened earlier. The influence on growth differed with the different species. Thus the growth of oats was slightly accelerated, that of flax and vetch was checked or stopped, that of mustard was decreased at the beginning and accelerated at the end of the growing period. It may be concluded that the introduction of heteroauxin in the seed modifies the growth processes without immediately affecting the formation of buds and flowers.

J.S.

11. KOMISSAROV, D. A. 577.15.04 : 635.976  
**Application of growth substances to increase rooting capacity in cuttings of woody species and shrubs.** [Russian.]  
 C.R. Acad. Sci. U.R.S.S., 1938, 18 : 63-8.

Winter and summer cuttings of 18 deciduous trees, shrubs and conifers were treated with 0.020 to 0.001% water solutions of  $\beta$ -indolylacetic acid for 6 to 72 hours. Results are tabulated. A higher percentage of rooted cuttings, greater root system and earlier rooting was determined after application of the optimal concentration, which varied from 0.02 to 0.005% according to species. An interesting result was achieved with *Picea excelsa*, the cuttings of which are difficult to root. Cuttings made in June and treated 24 to 32 hours with 0.005% solution of heteroauxin rooted up to 93%. The effect of phenylpropionic, phenylacetic acid,  $\alpha$ -naphthalene acetic acid, urine and maize flour extract was similar but less pronounced than that of heteroauxin. The compounds proved ineffective on some species. The effect of growth substances depends on the plant species, age of plant, wood development and time of taking cutting.

J.S.

12. ŠMIDRKAL, B. 577.15.04  
 Vzrustové látky při vzrůstu a výnosu rostlin. (**Growth substances and the growth and yield of plants.**)

*Čsl. Zeměd., 1938, 20 : 330.*

Seedlings of celery, *Apium graveolens* var. Imperator, treated with 0.01% solutions of  $\alpha$ -naphthaleneacetic acid,  $\beta$ -indolylacetic acid and indolylpropionic acid furnished roots weighing on the average 0.92 kg., 0.95 kg. and 0.85 kg. respectively, while the control roots had a weight of 0.58 kg. each.

J.S.

13. CHAILAKHYAN, M.KH., AND ZHDANOVA, L. R. 577.15.04 : 612.014.44  
**The formation of growth hormones. I. Photoperiodism and creation of growth hormones.** [Russian.]

*C.R. Acad. Sci. U.R.S.S., 1938, 19 : 107-11.*

Changes in the content of growth hormones due to photoperiodism and their possible influence upon growth and development of plants have been studied. Long-day plants, white mustard and lupin; short-day plants, hemp and *Chrysanthemum indicum*, and a day-neutral variety of sunflower were chosen for the experiment. All these plants grown under long-day conditions

contained more growth substances than when grown under short-day (10 hours) conditions. Thus long-day plants contained more growth substances during reproductive growth and short-day plants during vegetative growth. It is concluded that the growth substances do not affect the formation of buds and flowers, their influence being confined to growth processes only.

J.S.

14. JAKEŠ, E. 577.15.04 : 581.12  
 Vliv heteroauxinu, indol-3-octové kyseliny, na dýchací pigmenty buněčné.  
 (Influence of heteroauxin, indole-3-acetic acid, on the respiration pigments of cells.)  
 [German summary.]

*Ann. Acad. tchécosl. Agric.*, 1938, 13 : 174-8.

Heteroauxin solutions 1 : 100,000, 1 : 10,000 and 1 : 1,000 were applied to pieces of apple of the variety "Panenské" and caused with increasing concentration and time gradual dark brown coloration. At the highest concentration the change of colour was already noticeable after 15 minutes. Methylene blue, 1 : 50,000, in the presence of pieces of apple, was discoloured by the same concentrations of heteroauxin. Thus it has been proved that heteroauxin stimulates the oxidation of apple chromogen. It is concluded that growth substances play an important rôle in the respiration processes of living plant tissues. The colour reaction did not appear when the pieces of apple were boiled. In view of the fact that anthocyanin development through oxidation of chromogen is rather probable, the question is being pursued further.

J.S.

15. TEMPLEMAN, W. G. 577.15.04  
 The effect of some plant growth-substances on dry-matter production in plants.  
*Emp. J. exp. Agric.*, 1938, 7 : 76-88, bibl. 29.

Decreases, but no significant increases in dry-matter production of certain plants, were obtained by spraying the foliage and by watering the sand in which they were growing (pot culture) with solutions of  $\beta$ -indolylacetic acid,  $\alpha$ -naphthylacetic acid, skatole and ascorbic acid. No positive response to growth substance treatment was obtained for plants grown with restricted or with an ample supply of nitrogen. No response was obtained by the treatment of white mustard seed before sowing with solutions of growth substances.

16. GRACE, N. H. 577.15.04  
 Effect of phytohormones on seeds damaged by formaldehyde and other disinfectants.  
*Canad. J. Res.*, 1938, 16 : 313-29 C, bibl. 11.

Experiments with cereal seeds demonstrate that the reduction in germination and early growth resulting from formaldehyde treatment can be largely overcome by adding the phytohormones, 1-naphthylacetic acid or 3-indolylacetic acid, to the disinfecting solution. The optimum concentration of the hormone for individual varieties of cereal lies between 0.01 and 5 p.p.m. Similar effects were also obtained with hormones after copper sulphate and hot water treatments. The method appears to have practical possibilities and may also be useful for comparing the physiological activities of different compounds. [Author's summary.]

17. OLIVER, R. W. 577.15.04 : 631.535  
 Preliminary tests with plant hormones in the rooting of greenwood cuttings.  
*Sci. Agric.*, 1938, 18 : 379-87, bibl. 6.

The work described here was carried out during the summer of 1937 to test the effectiveness of the better known commercially prepared plant hormones in competition with solutions of indolebutyric acid made locally, and if possible to determine optimum treatment to induce rooting in various species and varieties of horticulturally important plants. The materials used were Hortomone A, Hormodin A, Auxilin and indolebutyric acid. Results, which are tabulated, show that the substances tested hasten rooting in greenwood cuttings and increase the percentage

of cuttings which root. Each species and variety has its own optimal treatment, which varies with the light, temperature and humidity conditions and with the degree of ripeness in the wood and the pH of the medium. Apple cuttings of the varieties tested did not respond to treatment. Optimum concentrations in terms of indolebutyric acid are noted for lilac, hydrangea, forsythia, roses, juniper, thuja and yew.

18. BROWN, W. T. 577.15.04

**The value of plant hormones or their substitutes in plant propagation.**

*Malay. agric. J., 1938, 26 : 414-9, bibl. 12.*

The general principles of the functions of plant hormones in root production are described and the application to practical horticulture of the knowledge now available is discussed. Plants may be classed as to their normal habits of rooting from cuttings, as easy, easy but slow, and difficult. The easy ones require no treatment with synthetic growth substances though they respond well to them by accelerated rooting. The easy but slow are usually evergreens which take a year normally but when treated will root in 6 to 8 weeks. Efforts to strike difficult cuttings by the aid of growth substances have not been markedly successful. In all cases response to synthetic growth substances has been largely confined to leafy cuttings; leafless cuttings seldom respond.

19. RASNIZINA, E. A. 577.15.04 : 576.85

**Formation of growth substances, auxin type, by bacteria.** [Russian.]

*C.R. Acad. Sci. U.R.S.S., 1938, 18 : 353-5.*

Twenty species and strains of bacteria have been tested by a modified Boysen-Jensen method on oat coleoptiles for their content of growth substances with the following results:—*Mycobacterium album*, *Azotobacter chroococcum*, *Pseudomonas fluorescens*, *Sarcina lutea* and *Bacterium vulgare* were found to produce high amounts of growth substances which produced curvatures of oat coleoptiles from 21.4 to 29.8 degrees. Bacteria producing a medium amount, such as *Rhizobium Leguminosarum*, or nil are listed. The property does not depend on genetic affinity and various strains of one species differ in respect to the intensity of production. The maximum production of growth substances is found in 8- to 16-day-old cultures and does not coincide with the stage of maximum growth. It is believed to be connected with decomposition. By this high production of growth substances soil bacteria may essentially influence the development of plants.

J.S.

*General.*

20. BEREZOVA, E. F., NAUMOVA, A. N., AND RASNIZINA, E. A.

631.847.2 : 577.15.04

**On the nature of "Azotogene" action.** [Russian.]

*C.R. Acad. Sci. U.R.S.S., 1938, 18 : 357-61.*

"Azotogene" is a fertilizing preparation made of unsterilized peat by the addition of a pure culture of *Azotobacter chroococcum*. The yield increase caused by this preparation has been ascribed to the ability of *Azotobacter* to fix nitrogen. *Azotobacter* is known, however, to produce also growth substances. A table shows the amount of growth substances produced by 12 species and strains of bacteria tested. Experiments with flax and wheat seeds wetted with suspensions of *Azotobacter* showed a stimulating effect which cannot be attributed to nitrification because the harvest was carried out during the seedling stage. Pot experiments with 3 wheat varieties in quartz sand fully fertilized chemically, including nitrogen, resulted in a remarkable yield increase when peat with pure culture of *Pseudomonas fluorescens* was added. Since *Pseudomonas* has no nitrification capacity and the yield increase caused by it is even higher than that of *Azotobacter* it is concluded that the stimulating effect of Azotogene is at least partly due to the growth substances produced by the bacteria. Seven Russian references to literature are cited.

J.S.

21. CANADA.

083 : 63

**Departmental directory and list of publications, 1938.***Publ. Dep. Agric. Canada* 526, 1938, being *Fmrs' Bull.* 14, pp. 26.

This is a useful summarized report of the activities of the Dominion of Canada Department of Agriculture with the list of the Department's publications. A new system of classifying and numbering publications, which was started in 1935, is explained.

22. BOURNE, J. B.

519 : 581.084

**The importance and use of appropriate assumed means in collating field experimental results statistically.***Trop. Agriculture, Trin.* 1938, 15 : 247-58, bibl. 4.

It is known that the use of an "assumed mean" will greatly lessen the labour of carrying out the statistical analysis of data from complicated experiments. Where, however, data from several such experiments are to be combined, the average yields of the trials may vary considerably even though the general trend of the results be the same. In such circumstances, the use of a single assumed mean for all the trials will not be of much assistance since deviations from it will, in many instances, be wide. This paper describes, with detailed examples, methods for combining results of several experiments when a different and appropriate assumed mean is used for each. [Author's summary.]

23. DE VORE, LL., POPP, H. W., HAM, W. R., AND DUNCAN, D. C. 535.214.4

**Methods of measuring radiation for biological purposes, including a new sensitometer method.***Bull. Penn. agric. Exp. Sta.* 359, 1938, pp. 40.

As well as discussing the usefulness of different methods and apparatus the authors give lists of other works on the subject as follows:—Radiometer 40 references; bolometer 39 refs.; thermopile 23 refs.; selective methods and instruments 9 + 3 + 7 + 4 refs.; photographic method for measuring the energy distribution of radiation in the visible and ultra violet 9 references.

24. TINLINE, M. J., AND BRAUN, E.

631.586

**Hints on dry land gardening.***Publ. Dep. Agric. Canada* 619, 1938, being *Circ.* 132, pp. 6.

Gardens on dry land should be protected from wind by trees, shelter belts and fences and attention should be paid to every detail that will aid in moisture conservation. Among many useful suggestions the following may be noted:—1. Hedges and trees should be employed to trap the snow on the gardens. 2. Where soil drifting is not a problem, a considerable part of the garden should be planted on summer-fallow each year. The heavy, sticky soils should be ploughed in the autumn, and light soils subject to drifting early in the spring. The seed beds should be prepared as soon as the soil is sufficiently dry to permit operations. All small seeds require fine firm seed beds. 3. In order to prevent soil drifting on light soils a covering of clean sweet clover hay is recommended. 4. The best fertilizer for gardens is an annual application of well rotted farmyard manure. A plentiful supply of all the necessary nutrients increases the rate of growth and thus may reduce the amount of moisture required by the plant. When commercial fertilizers are used, due care should be exercised not to bring them into contact with the seeds. 5. Leaf vegetables should be grown alternately with root vegetables and legumes. 6. Suitable vegetable varieties should be chosen. 7. Both early and late varieties should be grown. 8. The vegetables should be planted as early in the spring as their frost hardiness permits. 9. Vegetables become more resistant to drought if the spacing between the rows is correct and the plants have a sufficient feeding area. 10. Vegetable seeds, particularly small seeds, must be planted in moist soil. Keeping the moisture close to the surface hastens germination. This can be achieved by pegging down strips of burlap or like material. 11. Frequent shallow cultivation is all that is needed to control the weeds, to maintain a surface mulch and conserve moisture. Deep cultivation is harmful. 12. By planting one half of the crop on a dry soil and the other on a lower situated part of the field, containing more moisture, a yield will be

secured from at least one portion of the garden independently of whether it is a wet or dry year. 13. The use of hotbeds and cold frames is recommended. 14. For the control of insects, which cause much more injury under drought conditions, the reader is referred to the bulletin "Garden insects and their control".

25. WALLIS, H. W. H. 631.67

**A small brick irrigation furrow.**

*Rhod. agric. J.*, 1938, 35 : 507-9.

The method described and clearly illustrated shows how a very small stream flow can be conducted across porous ground to the irrigation points without recourse to expensive pipe lines. A brick-lined furrow was constructed, the bottom being lined by bricks laid side by side transversely and the sides by bricks on edge placed longitudinally and overlapping the bed on each side by  $1\frac{1}{2}$  inches. Cement mortar was used throughout to lessen the chances of grass and weeds opening up the joints. The average number of bricks per linear yard of furrow was 14. A deep water course which intervened was crossed by a 4-inch pipe siphon, supported on brick pillars and fitted with a scour box at the lower end. Small gullies were crossed by 4-inch pipes. The furrow is 6 inches wide and can take  $4\frac{1}{2}$  inches depth when full, which on a grade of 1 : 600 gives a capacity of 0.16 cu. secs. The furrow after completion was lined with cement mortar. A small storage reservoir near the land is advisable.

26. BYERS, H. G., MILLER, J. T., WILLIAMS, K. T., AND LAKIN, H. W. 546.23 : 631.416

**Selenium occurrence in certain soils in the United States with a discussion of related topics. Third report.**

*Tech. Bull. U.S. Dep. Agric.* 601, 1938, pp. 74, bibl. 39.

In Technical Bulletins 482 and 530 the results have been summed up of the selenium studies carried out in the Soil Chemistry and Physics Research Division up to and including the calendar year 1935. The present report presents the results obtained in 1936.

27. C.A.S.B.\* 55.087 : 016

**A bibliography on dowsing.**

Being a list of 120 references to water divining, 1938, (stencilled).

**TREE FRUITS, DECIDUOUS.**

*General.*

28. BORISOGLEBSKY, A. D. 634/5 : 581.084

**Horticultural and viticultural advisory centres in U.S.S.R.** [Russian.]

*Sci. Fruitgrowing, Mitchurinsk*, 1938, No. 5, pp. 71-84.

185 addresses are given here of what the writer calls "research institutes". From these advisory centres, which appear to be distributed throughout U.S.S.R., not only advice but also various plant material and seeds may be obtained. Where known notes are given on payment arrangements and on plant material available. Horticulturists and viticulturists are advised to apply first to their local centres, and only when these advisory centres are not in a position to supply them with the plant material required or information needed, to write to U.S.S.R. Institute of Plant Industry, Nikita Botanical Gardens and other larger institutes.

29. GUSEV, P. P. 634.1/7-1.541

**Forest orchards. (The problem of reclaiming wild fruit trees.)**

*Nov. sel. Khoz., Moscow*, 1938, No. 24, pp. 42.

In an attempt to reclaim the vast resources of wild fruit trees in U.S.S.R., considerable work has

\* Central Agricultural and Scientific Bibliography, Science Museum, London S.W.7.

been carried out by the Maikop Branch Station of the Institute of Plant Industry. The conclusion is reached that the common species of wild fruit trees and nuts can be profitably grafted at any age with desirable cultivated varieties. Methods applicable are discussed and the recommendation is made that, where possible, framework should be adopted. It is noted that the best time for grafting is the period between the initiation of bud burst and the end of flowering. Wild shoots must be kept down and deep cultivation in early spring results in increased new growth of the scions inserted.

30. REITER, R. 634.11  
*Der steirische Obstbau. (Fruit growing in Styria.)* [English summary  $\frac{1}{2}$  page.]  
*Ernähr. Pfl.*, 1938, 34 : 269-73.

Recommendations, apparently not based on any local research, are made for the renovation of apple orchards in Styria and a full manurial programme is suggested for use in this age-old apple producing district of Austria. The majority of the trees are grown in grass and one of the recommendations made is to plough the grass up and grow root crops using heavy applications of manure for a number of years before laying down to grass again. When this is impossible fertilizers should be applied in trenches round the trees.

31. GORING, E. T. 634/5  
*Horticulture in northern Ontario.*  
*Sci. Agric.*, 1938, 19 : 110-6.

The paper presents the conditions in one of the large pioneering districts of Canada to show that horticulture should be the basis upon which to build a programme of agricultural development. Raspberries, strawberries, black and red currants do well, gooseberries less so. Blueberries grow wild. Of apples only 4 varieties of crabs have been found hardy enough to survive the winters at Kapuskasing, but in the west Hibernal, Wealthy and Duchess are fairly successful, not yet, however, on any large scale. No plums or cherries have been found suitable to stand the combination of great cold and heavy, poorly-drained soils. On the other hand all the common vegetables can be grown except those requiring a long season of warmth. Tomatoes will bear heavily to the green fruit stage. Potatoes are very successful. The enthusiast for ornamentals will find plenty of suitable material.

32. JURION, F. 634.1/7  
*Les cultures fruitières en Rhodésie du Sud et dans l'Union Sud-Africaine.*  
*(Fruit growing in S. Rhodesia and in S. Africa.)*  
*Bull. agric. Congo belge*, 1938, 29 : 32-53.

A survey is made of the present state of fruit growing research and industries of Southern Rhodesia and the Union of South Africa. Considerable attention is paid to the varieties grown and to the rootstocks employed. Both deciduous and non-deciduous fruit growing is dealt with. The information now given has appeared in *Horticultural Abstracts* at one time or another in expanded form and from direct sources but, as it fully summarizes the position, this paper should be useful.

33. GOSSELIN, A. 634.11-1.16  
*Costs and returns in apple production, Rouville County, Quebec.*  
*Publ. Dep. Agric. Canada* 624, 1938, being *Tech. Bull.* 17, pp. 15.

As a result of a farm survey conducted in Rouville County for several years sufficient data have been obtained to allow of definite conclusions on financial returns, cost of production and marketing and man labour requirements on fruit farms in that county.

34. HAVIS, L., AND GOURLEY, J. H. 634.25 + 634.26  
*Peach production in Ohio.*  
*Bull. Ohio agric. Exp. Sta.* 581, 1937, pp. 41, bibl. 23.

The main points in the cultivation of peaches and nectarines in Ohio are discussed, special stress being laid on local problems. Notes are given on propagation, choice of varieties, selection of

soil and site, lay-out of orchard, planting, care of young trees, orchard management, fertilizers, pruning, thinning, harvesting, marketing and storage. Pests and diseases are dealt with elsewhere.\*

35. STEKHUN, F. I. 634.13 : 581.192  
 Chemical and technological investigations of the Mitchurin pear varieties.

[Russian.]

*Sci. Fruitgrowing, Mitchurinsk*, 1938, No. 5, pp. 18-24.

Several Mitchurin pear varieties have been tested by the Technology Department of the Mitchurin Research Institute for flavour and suitability for canning and drying. Trials have led to the following conclusions:—These pears give a fine product, when cooked, candied, dried or prepared in some other way. They contain 8·2-13·1% more flesh than other varieties. Varieties having a particularly fine flavour and other useful characters are noted. Russian Malgorzhatka was found to contain most sugar (14·37%), its acid content being similar to that of fine Crimean pears.

36. GOULD, H. P. 634.14  
 Quince growing.

*Leaf. U.S. Dep. Agric.* 158, 1938, pp. 4.

In this leaflet the more important points in the cultivation of quinces are considered under the following headings:—habit of growth, soils, selection of trees for planting, planting, care of trees, pruning, diseases and insects, varieties and propagation.

37. PENNSYLVANIA. 634.1 : 581.084  
 Guide to the agricultural experiment station.

*Bull. Pa agric. Exp. Sta.* 360, 1938, pp. 44.

Among particularly interesting horticultural projects the following may be noted:—Pear breeding for resistance to fire-blight; cabbage and tomato breeding; orchard soil management; orchard soil conservation; apple and cherry rootstocks; control of pests; apple nutrition studies in sheet metal cylinders plunged into the ground.

#### *Varieties.*

38. GRUNNET, H. Ø. 634.11  
 Danske lokalsorter af aebler. (Danish apple varieties.)

Reprinted from *Tidssk. Planteavl.*, 1938, 43 : 346-60.

Notes are given on amount and periodicity of cropping, storage qualities and season of consumption of the more important apple varieties grown in Denmark.

39. MEIER, K. 634.1/2-1.523.  
 Zur Sortenfrage im Obstbau. (The problem of fruit varieties.)

Reprinted from *Schweiz. Z. Obst- u. Weinb.*, 1938, vol. 47, pp. 20, bibl. 13 and Die Beschaffung neuer Sorten und die bisherige Tätigkeit der Eidg. Versuchsanstalten für Obst, Wein u. Gartenbau. (The provision of new varieties and the work of the Wädenswil Research Station in connexion therewith.)

Reprinted from *Schweiz. Z. Obst- u. Weinb.*, 1938, vol. 47, pp. 21, bibl. 14.

In the first paper the author considers what should be the guiding principles in selecting fruit varieties. In choosing a variety it is not merely a matter of saying that such and such a variety has certain particularly good characteristics and should therefore be planted. Some of the factors which must be considered before reaching a decision are the influence on the variety in question of rootstock, soil, manuring, pruning, pests and diseases, pollination conditions and climate. If the planter can fulfil enough of the demands of the particular variety in those respects to produce the desirable characteristics, well and good, if not he may have to choose another variety.

\* *Bull. Ohio agric. Exp. Sta.* 562, 1937.

In the second paper, which is a continuation of the first, Dr. Meier gives an account of the work of the Wädenswil research station and brings out the following points. *Apples*.—New varieties are submitted to a preliminary test and only considered further if they pass it. Seven Swiss and 21 foreign varieties have survived this test and are now being further examined. Seedlings from known mother parents are now producing fruits and should prove their worth in the next few years. In addition seedlings of which both parents are known, these being mainly Delicious, Glockenapfel, Ontario Reinette and Jonathan, already number 4,400 and are ready for testing. *Pears*.—Not much serious work has been done on dessert pears. *Zwetschgen and plums*.—The number of varieties, not counting new ones received from abroad, is 68, as well as 12 apricots and 10 peaches. A collection of fruit from different Swiss sources has been undertaken for some years and Wädenswil possesses a collection of stones from 105 plum and zwetschgen, 14 apricot and 39 peach varieties. *Cherries*.—In addition to varietal investigations reported elsewhere attempts are being made to produce a satisfactory clonal rootstock for cherries. From 7,700 seedlings some 600 have already been selected and are now to be subjected to more searching tests. *Walnuts*.—The attempt is being made to find strains which will bloom later and so be less subject to frost damage without being so late as to fail to ripen. Collections are being made of Swiss and foreign strains.

*Breeding.*

40. DUKA, S., AND SOKOLOVSKY, I. 575.14 : 634.75 : 581.162.3  
**Reasons for not inbreeding.** [Russian.]

*Sci. Fruitgrowing, Mitchurinsk*, 1938, No. 5, pp. 25-32, bibl. 14.

In 1934 the inbreeding of strawberries, raspberries and apples was started at the Uman Agricultural Institute. The results of the experiments with strawberries are reported here in some detail. Among the conclusions reached are the following:—Pollinating plants with their own pollen results in progeny inferior to those obtained by pollination with other plants of the same variety. Their growth is depressed, they are less adaptable to external conditions and their quantitative and qualitative indices are lower. Of 9,899 inbred strains from 6 large-fruited strawberry varieties not a single strain produced a better form than the parental plants. Hence inbreeding cannot be recommended as a method of producing high-yielding, high-quality varieties. Interspecific and intraspecific hybridization based on Mitchurin's ideas of selecting the parent pair and raising the hybrids should be the fundamental basis for selection of the large-fruited strawberry.

41. PISKAREV, V. I. 581.142 : 634.1/2-1.531  
**Germinating pome and stone fruit seeds without a dormant period.** [Russian.]

*Sci. Fruitgrowing, Mitchurinsk*, 1938, No. 5, pp. 39-48.

Investigations were made by the Selection Department of the Mitchurin Fruit Research Institute into the effect of eliminating the dormant period on the viability of the seed and subsequent seedling development. Various apple, pear, cherry, plum, peach and apricot seeds were used in the experiments, which are described here in some detail. The report is tabulated and illustrated. The author reached the following conclusions:—1. A higher percentage of stone fruit seeds germinates when the dormant period is omitted, the removal of all seed-coats being necessary. In the case of peach and apricot a considerable number of seeds germinate if the stones alone are removed. 2. Only 4-6% of the pome fruit seeds with seed-coat removed will germinate without previous stratification. The viability of wild crab seed gradually increases as the seeds pass a dormant period of 25-30 days, it then rises abruptly and on the 35th day or so it is almost as high as that of seed that has passed a complete dormant period. 3. The germinating activity of unstratified seeds with seed-coats removed and the strong development of the seedlings raised from such seeds indicate strongly that during the time of stratification the plants undergo a certain stage of development, which closely resembles Lysenko's vernalization stage.

42. BELOKHONOV, I. V. 634.1/2-1.531  
**The storage and preparation for sowing of pome and stone fruit seed.** [Russian.]  
*Fruits and Vegetables, Moscow, 1938, No. 10, pp. 46-51.*

As a result of considerable research and examination of commercial data by the Mitchurin Research Institute certain conclusions have been reached on storing and treating the seeds of pome and stone fruits prior to sowing. The following points are discussed: *Seed selection*.—In order to obtain seedlings that will suit climatic and soil conditions, seeds should be collected for sowing from the same geographical area. Fully ripe apples and pears with early or medium-early dates of maturity give seed with good germinating capacity. The opposite, however, is the case with stone fruits, where stones from early-ripening fruit trees have poor viability. *Seed treatments*.—Both dry and wet methods are used for production of pome fruit seed. In both cases high temperatures must be avoided since these affect the vitality of the seed. The cleaning and drying of the stones immediately after their removal from the fruit is essential in the case of cherry, plum and other stone fruit seeds. *Seed drying*.—Under commercial conditions artificial heat must be employed. Drying at very high temperatures results in destruction of power to germinate; on the other hand if the temperatures are too low the drying proceeds slowly, the seed gets hot, starts fermenting and becomes mouldy. Drying apple seed at 40° C. gave the best results. Pome fruit seed should be dried at 35° C.-40° C. and stone fruit seed at temperatures not exceeding 25° C. The final product must be free from undesirable elements such as earth, unhealthy or damaged seeds, etc. The moisture content of the seed may not exceed 15-16%. *Determining seed viability*.—One of the more accurate methods for determination of seed viability is the dye method of D. N. Nelyudov and V. I. Piskarev, consisting essentially in the following:—The seeds from which, after previous soaking in water, all coats have been removed, are left for three hours in indigo-carmine solution (1 : 500 or 1 : 1,000 according to the kind used). They are then washed with water. All seeds retaining or partially retaining the pale blue colour after washing will be non-viable. Healthy seeds are entirely unaffected by the dye. *Preparing the seed for sowing*.—The length of the stratification period of the various seeds prior to sowing is noted. Two points on the stratification period appear of particular interest:—1. The seeds from stone fruit that do not crack their shells during the stratification period will not, as observations showed, germinate in the current year. 2. In order to obtain simultaneous germination of stone fruit seeds stratifying the stones at +3 to +5° C. until the first cotyledons appear is recommended. As soon as these appear the temperature should be lowered to +1 to +2° C.

*Propagation.\**

43. MOEN, O. 631.535 : 635.9  
**Forsøk med urtaktig stikning av busker og trær i planteskolen.** (**Herbaceous cuttings of some ornamentals.**)  
 Reprinted from *Norsk. GartForen. Tidsskr.*, No. 15, 1937, pp. 4.  
 MOEN, O. 631.535 : 634+635  
**Fra planteskoleforsøkene ved Norges Landbrukskole. Urtaktig stikning av treaktige planter.** (**Nursery investigations in Norway. Herbaceous cuttings of woody plants.**)  
 Reprinted from *Norsk. GartForen. Tidsskr.*, No. 18, 1937, pp. 3.  
 MOEN, O. 631.535  
**Noen iakttagelser vedkommende urtaktig stikning i planteskolen.** (**Nursery observations on herbaceous cuttings.**)  
 Reprinted from *Norsk. GartForen. Tidsskr.*, No. 19, 1937, pp. 2.

All three articles give accounts of nursery trials made in Norway with various herbaceous cuttings.

\* See also 230.

44. TALBERT, T. J. 631.541.44 : 634.1/2  
**Top and double working and bridge grafting of fruit trees.**  
*Circ. Mo. agric. Exp. Sta.* 196, 1938, pp. 16.

In this paper some of the grafting and budding methods such as cleft-, bark-, notch-, side-cleft-, and bridge-grafting are described and illustrated. Double working is discussed, terms used in grafting or budding are explained, and notes on grafting wax, waxed tape and waxed string are given.

45. FRISCHENSLAGER, B. 631.535.6 : 631.541.11 : 577.15.04  
**Versuche über die Heranzucht von Unterlagen aus Wurzeln und die weitere Vermehrung derselben. (Rootstock propagation from root cuttings.)**  
*Gartenbauwiss.*, 1938, 12 : 77-88.

Root cuttings from apple seedling varieties rooted with ease while out of many thousand root cuttings of known varieties rooting was obtained in only two cases of root cuttings of the Canada variety despite the use of growth substances in paste and solution form. Of the Malling rootstocks tested, namely apple rootstocks I, II, IX and XII, Quince A and B and Myroblolan A, only in type IX and in quinces A and B could the root cuttings be induced to root.

#### *Rootstocks.*

46. TUKEY, H. B., AND BRASE, K. D. 631.541.11 : 634.1/2 and 631.532/5 : 634.1/2  
**Random notes on fruit tree rootstocks and plant propagation III.\***  
*Bull. N.Y. St. agric. Exp. Sta.* 682, 1938, pp. 32, bibl. 15.

Granulated peat moss placed in the tree hole at planting in a heavy soil resulted in increased root and top growth of apple trees in two out of three successive plantings. There are indications that the peat moss helps in aeration in wet seasons. Experiments with many thousands of plants show that Malling stocks give as good a stand of lining out stock as a good grade of branch-rooted seedlings. Compared with straight-root seedlings they have been superior. In the past normally 3 growing seasons have been required to produce a yearling tree of the common tree fruits. It is found that this can be shortened a year by starting the seedlings in the greenhouse, transplanting to the field in late spring and budding in midsummer. Tests show that sour cherries wintered out of doors make better growth than those dug in the autumn and wintered in a nursery cellar. Tests with some 100 2-year-old trees show that paper mulching resulted in the same height of tree with a slightly greater diameter than was found in clean cultivated trees. Budding young apple trees at 3-4 inches above the crown resulted in slightly larger 2-year-old trees and a better stand than budding at 1-2 inches above the crown and much better trees than budding at or below the crown. An examination of the roots of vigorous and of weak young pear trees showed that starch grains were abundant in the roots of the vigorous trees and almost absent from those of the weak trees. A 6-year-old orchard of Early McIntosh trees propagated on a good grade of French crab seedlings and treated carefully throughout its history shows a great measure of uniformity in growth and conformation. It has been found that in the tea crab, *Malus hupehensis* (Pamp) Rehd., the seeds have apogamic embryos. This suggests its value for the production of uniform rootstock material. So far, however, its low number of viable seed and its poor germination render it unsuitable for this purpose. Peat moss proved useful when used as a surface cover on seed beds for fruit tree seeds and as a complete cover over seed planted under unfavourable conditions of excessively high humidity and consequent damping off.

\* For II see *H.A.*, 6 : 442.

47. DICKSON, B. T., AND THOMAS, L. A. 634.1/2-1.541.11  
**Stock and scion investigations. I. The problem and the plan of experiments at Stanthorpe, Queensland.**  
*J. Coun. sci. industr. Res. Aust.*, 1938, 11 : 169-74, bibl. 4.  
 A statement is made of the rootstock problems under investigation and the progress made under the direction of the C.S.I.R. in the Stanthorpe district of Queensland. The object is to find suitable stocks to replace the almost ubiquitous Northern Spy. At the same time a programme for plum and pear stock research has also been drawn up.

48. THOMAS, L. A. 634.11-1.541.11  
**Stock and scion investigations. II. The propagation of own-rooted apple trees.**  
*J. Coun. sci. industr. Res. Aust.*, 1938, 11 : 175-9, bibl. 8.  
 This paper amplifies part of the information contained in that forming the subject of the previous abstract. Some 32 apple varieties were mound layered at Stanthorpe, Queensland, to produce own rooted trees. By this method practically all varieties gave a commercial yield of trees, taking the yield of the commonly used Northern Spy rootstock as a standard. A table of results is given which includes a brief description of each of the one-year-old root systems at transplanting and degree of woolly aphis attack, if any. No trees were lost at transplanting.

49. UPSHALL, W. H. 634.11-1.541.11  
**Malling stocks and French crab seedlings as stocks for five varieties of apples. II.**  
*Sci. Agric.*, 1938, 18 : 370-8, bibl. 5.  
 A previous report on the comparative trial of commercial apple varieties on clonal and seedling stocks at Vineland was reported in *Sci. Agric.*, 1935, 15 : 535-41, *H.A.*, 5 : 342. The scion varieties are R. I. Greening, Melba, Delicious, Spy and McIntosh. The stocks are French Crab seedlings, Malling XVI, Malling II and Malling I. Results clearly show that different varieties respond differently to stock influence. Environment seems to affect this influence. Thus at Vineland Malling II has proved a better stock than I for McIntosh but in Massachusetts there are indications that the reverse is the case. Malling I seems also to do well in B.C., but where there is low potassium availability, as in parts of Ontario, it does not appear to do so well. The author is led by his results to the opinion that in early years at least the variability of apple trees cannot be materially reduced by the use of clonal stocks and that soil condition, physical and chemical, is a more potent factor in creating variability than stock. The classifications after 8 years' trials at Vineland are as follows :—Trees on French Crab and XVI very vigorous, on I vigorous, on II semi-dwarfing. Trees on I are smaller than on II and there is no indication of any change in this respect. Except in Melba, where French Crab trees just have first place, II trees lead in fruit production per tree. The larger crops on II and I did not react unfavourably on fruit colour. There is, however, a suggestion that XVI may produce McIntosh apples of superior colour. Trees on I appear to be suffering from potash starvation considerably more than those on other stocks, which may explain their slow growth. So far trees on clonal stocks have been less variable in fruit production but no less variable in vegetative growth than trees on seedlings. Trees on IX situated at the side of the orchard have been outstanding in precocity and heavy fruit production. Their fruit has matured earlier and has been more highly coloured than that produced on any of the other stocks and of satisfactory size despite the heavy cropping. Most of the data are based on the means of 16 trees of each variety on each stock.

50. BLAIR, D. S. 634.11-1.541.11/12  
**Rootstock and scion relationships in apple trees.**  
*Sci. Agric.*, 1938, 19 : 85-94, bibl. 26.  
 Investigations are reported from Canada on the influence of the intermediate stem-piece in double-working upon the vigour and precocity of a scion together with its effect upon growth and character of a rootstock. The rootstocks used were known as Miscellaneous Seedling French Crab, non-clonal rootstocks being purposely used, the scion was Bramley Seedling, and the intermediates were East Malling Nos. IX, II and XIII, 9 inches in length. The results are

discussed at some length. It is claimed that one point clearly established of fundamental and practical importance is that the so-called rootstock effect on the growth and precocity of the scion can be produced by an intermediate without the aid of the root system provided the latter is of accepted vigour. The author sees in this result the provision of an almost infinite range of "rootstock effects" to be built up on an absorbing root system, concerning which little need be considered but its suitability to the climate and the soil.

51. SOUČEK, J. 634.11-1.541.11  
 Předběžné výsledky pokusů s ovocnými podnožemi pro jabloně. (Preliminary results of experiments with apple rootstocks.)  
*Zahradnické Listy*, 1938, 35 : 325-7.

The following stocks obtained in 1935 from East Malling together with apple seedlings have been tested at Průhonice: E.M. IX, II, I, XII, XIII and XVI. In 1936 they were budded with the following varieties:—Yellow Transparent, James Grieve, Mother, Cox's Orange Pippin, Ontario, Transparente de Croncels and Malinové hornokrajské. Results obtained in the nursery are reported:—All varieties tested showed the weakest growth on E.M. IX. Some already gave good fruits in the second year in the nursery. E.M. IX can, therefore, be recommended as a stock for the smallest forms. E.M. II is also considered a good stock for dwarf trees. Some fruits were formed in the second year after budding. On E.M. I fruiting wood was formed in the second year and the growth was vigorous so that this stock is recommended for half-standards and standards. Of E.M. XII and E.M. XIII the latter seems to furnish better growth and fertility. E.M. XVI was a disappointment under Průhonice conditions; it neither produced vigorous growth nor early fertility. The growth of the varieties budded on apple seedlings showed growth similar to that on E.M. XII and E.M. XIII. Ten examples of every variety tested on the respective stocks are to be planted out for further observation. J.S.

52. MARGOLIN, A. 634.11-1.541.11  
 Rootstock Influence. [Russian.]  
*Sci. Fruitgrowing, Mitchurinsk*, 1938, No. 5, pp. 52-6.

In the present article an account is given of rootstock studies made in 1937 in Ukraine, Russian Moldavia and Crimea. The results may be summed up as follows:—The most widely distributed stocks in all three localities were Types III and VIII, and possibly II and V. In Ukraine, Moldavia and Crimea Type VIII may be considered as a standard type (which it cannot at Malling.—ED.), given suitable scion varieties, proper cultural treatment and sufficient wind protection. Type III is recommended on account of its vigour, hardiness and drought resistance as a vegetatively propagated stock for vigorous semi-dwarf trees in the three named localities and in Central Russia. No definite conclusions could be drawn on the influence upon scion of II, IV, V and XVII, owing to insufficient experimental material.

53. KENCH, J. E. 634.11-1.541.11 : 581.192  
 The seasonal cycles of ash, carbohydrate and nitrogenous constituents in the terminal shoots of apple trees and the effects of five vegetatively propagated rootstocks on them. III. Nitrogenous constituents.  
*J. Pomol.*, 1939, 16 : 346-63, bibl. 11.

This is the third of a series of papers from Long Ashton on the seasonal cycles of important constituents of terminal shoots of apple trees, the other two having appeared *Ibidem*, 1938, 16 : 101-26 and 16 : 185-200, *H.A.*, 8 : 983, 984. From the investigations it is evident that all the chief nitrogen fractions occurred in definite cycles associated with certain seasonal phases and parts of the shoot, but that the rootstocks except E.M. IX did not affect any of the cycles significantly. A brief note on the work of Karmarkar, of Colby, and of Wallace and Warne is followed by notes on the methods used in the present trials, the rest of the paper being devoted to the results achieved and a discussion of their significance. The material used was Lane's Prince Albert apple grafted on E.M. II, V, VII, IX and B. Samples were collected monthly from 8 trees on each rootstock from January 1934 for a year. Procedure was as described by

Karmarkar (*J. Pomol.*, 1934, 12 : 177-221, *H.A.*, 4 : 526) with the exception of the van Slyke estimation of amino acid. Determinations were made of total N, total non-protein N, ammonia, acid amide, humin, basic imide, mono-amino and proteose nitrogen. The cycles were similar in trend to those found by Karmarkar for the Newton Wonder apple on E.M. II. E.M. IX produced in the scion significantly high total nitrogen in the wood with a tendency to accumulation of acid amide, but no significant differences were observed between the composition of shoots of trees on the other rootstocks.

54. WARNE, L. G. G., AND RABY, J. 634.11-1.541.11 : 581.12  
**The water conductivity of the graft union in apple trees, with special reference to Malling rootstock No. IX.**

*J. Pomol.*, 1939, 16 : 389-99, bibl. 12.

The first determinations of water conductivity were made on a few miscellaneous lots comprising maidens of Lane's Prince Albert on E.M. IX and XII, 3-year-old Lane's Prince Albert on E.M. IX and on a free stock and 2-year-old Bramley Seedlings on E.M. IX and on a crab stock. Later approximately 80 double-worked Stirling Castle trees became available and were also used. The authors summarize as follows:—"The water conductivity of the graft union in a number of apple trees, both single- and double-worked, has been measured. The aim has been to compare the efficiency of unions in which Malling IX stock was one component with that of unions in which a vigorous stock was combined either with itself or with a scion. The conductivity of the unions has been expressed as a percentage of the means of the conductivities of the stem above and the stem below the unions. It has been shown that unions of M. IX with certain scion varieties, and unions of M. IX with M. XII are less efficient than unions of M. XII with M. XII, M. IX with M. IX, M. XII with certain scion varieties, and seedling stocks with certain varieties. When expressed as a percentage of the conductivity of the scion, the conductivity of the intermediate in double-worked trees was greatest when intermediate and stock were unlike. When expressed as a percentage of the conductivity of the scion, the conductivity of the stock in the double-worked trees was less when M. IX was the stock than when M. XII was the stock. The extent to which the union in these cases influences the water economy of the tree cannot fully be assessed, but it is pointed out that certain growth characters of trees on M. IX stock are features that might be expected if the water supply to the shoots was somewhat restricted. It is not possible to say whether the reduced efficiency of unions in which stock M. IX forms one component is an expression of partial incompatibility between stock and scion."

#### *Pollination.*

55. LYUBOCHKO, O. 581.162.3 : 634.11  
**The time for pollinating apple flowers in relation to different methods of emasculation.** [Russian.]

*Sci. Fruitgrowing, Mitchurinsk*, 1938, No. 5, pp. 33-8.

In 1936 pollination trials were carried out at the Krasnoyarsk Fruit Research Station. Three uniform 12-year-old apple trees of the variety Reinette Purpurnaya were used. The castration methods employed were those of Sax, Burbank and Mitchurin. The last method consists in removing the anthers and leaving the pericarp on the flower. This pericarp and gauze isolations give the flower a certain degree of protection against atmospheric and climatic influences. The author reached the following conclusions:—1. The best results are obtained from pollinating by all three methods on the first day of full bloom. The receptivity of the pistil is generally markedly better during the first 4 days of flowering. This is particularly characteristic when Mitchurin's or Sax's castration method is employed. The receptivity of the pistil is reduced much more rapidly when the Burbank method of castration is used. 2. Mitchurin's castration and isolation method proved to be highly effective and reliable, while it also secured that no accidental fertilization of the flower occurred by other pollen. In using Burbank's method one runs a risk, since in this case the receptivity of the pistil is already greatly reduced on the second

day of full bloom. Sax's method is highly effective and reliable as regards the production of pollen seed, the method is a very quick one, and there is no need for isolation material, but the incidence of up to 3% seed from accidental pollination is possible.

56. ROY, B. 581.162.3 : 634.23 + 634.22

**Studies on pollen tube growth in *Prunus*.**

*J. Pomol.*, 1939, 16 : 320-8, bibl. 4.

The pollinations described here on sweet cherries and plums were carried out on trees grown under controlled conditions in the greenhouse. The flowers were emasculated and the stigmas were hand pollinated when receptive a few days later. The author summarizes his results as follows:—"Histological studies have shown that in the self-incompatible cherry, Noir de Schmidt, treatment of the styles with phenylacetic acid has no accelerative effect on pollen tube growth or fruit development. The proportion and rate of growth of pollen tubes which penetrated the styles were found to be approximately the same in the treated and untreated styles following self-pollinations. Treatment of the styles with naphthalacetic and indolylacetic acids also had no effect on the setting or development of fruit. In the self-incompatible plum, Coe's Golden Drop, when self-pollinated, the pollen tubes are arrested in the stylar tissue and their ends often swell up. Plum styles pollinated with compatible and partially compatible varieties were also investigated. It was found that in addition to pollen tubes which travel the full length of the style and effect fertilization, tubes also occur which are arrested in the stylar tissue and swell up at their ends, thus indicating the existence of two pollen genotypes. Inter-specific pollinations were also studied. In *Prunus divaricata* (diploid) pollinated with *Prunus domestica* (hexaploid), pollen tubes were observed in the ovarian cavity seven days after pollination. From this cross 6% of fruits set and matured. In the reciprocal cross 15% of fruits reached maturity. The rate of growth of a diploid pollen tube in a hexaploid style is much more rapid than that of a hexaploid pollen tube in a diploid style."

57. VAN STUIVENBERG, J. H. M., AND ZWEED, A. K. 581.162.3 : 634.1/2

Handleiding bij de keuze van bekende appel-, peer-, pruim- en kersvariëteiten voor het gebruik in boomgaarden en fruittuinen, in verband met bevruchtingsmogelijkheden. (**Handbook of apple, pear, plum and cherry selection to ensure pollination in orchards.**)

*Meded. Lab. Tuinbouwpl. Wageningen*, 32, 1938, pp. 56, fl. 0.30.

The bulletin consists chiefly of tables in which the better known varieties of the fruits mentioned in the title are listed with the names of varieties suitable for their cross-pollination appearing in a parallel column. The relative position of each in the sequence of bloom (full bloom in Holland) is indicated by a numeral. In pears the viability of the pollen and any tendency to parthenocarpy is also noted. There are 21 pages of preliminary explanation.

58. KOBEL, F., STEINEGGER, P., AND ANLIKER, J. 634.23 : 581.162.3

Weitere Untersuchungen über die Befruchtungsverhältnisse der Kirschenarten. (**Further investigations on cherry pollination.**) [German and French summaries.]

Reprinted from *Landw. Jb. Schweiz*, 1938, pp. 564-95, bibl. 10.

An account is given of the further investigations on cherry pollination of Kobel and his group since 1934 at the Wädenswil station (for earlier experiments see *Ibidem* for 1933, *H.A.*, 4 : 45). Up to date some quarter of a million cherry flowers have been artificially pollinated. In all 95 of the sweet cherry varieties examined proved self-sterile. Inter-sterility was also frequent. It was possible to classify 56 varieties into 17 inter-sterility groups, each group consisting of from 2 to 5 varieties. Technical reasons have prevented hitherto the combination of all the groups with each other, so that further investigations might possibly show some of these groups to be identical. It was possible to follow the action of the pollen tubes in the styles by means of cotton blue dissolved in lactophenol. Where pollination was done with pollen from the same variety or from that of inter-sterile varieties the pollen tubes did not get beyond the top of the

styles, where they presented a swollen appearance with thickened walls. When dealing with inter-fertile combinations one of two things happened:—either all the tubes travelled the whole length of the style, or half of them stopped in the apical part of the style, a fact which allowed conclusions to be drawn on the sterility factors of particular varieties with one another. These factors behave like those of *Nicotiana Sanderae* (East) and of *Veronica syriaca* (Lehmann). It was found possible to enumerate the sterility factors of 10 varieties and thus to show the connexion between some of the inter-sterile groups. These 10 varieties possessed in all only 7 sterility genes, which explains the frequency of inter-sterility in sweet cherries. The results of the artificial pollination trials on 95 varieties crossed with pollen from other named varieties are given together with notes on appropriate pollinators in each case.

59. RUDLOFF, C. F., AND SCHMIDT, M. 581.162.3 : 634.1/2  
Befruchtungsbiologische Studien an *Malus*-, *Pirus*- u. *Prunus*-Arten. (Pollination studies in *Malus*, *Pirus* and *Prunus*.)

*Gartenbauwiss.*, 1938, 12 : 145-69, bibl. 31.

Self-pollination was carried out in a number of *Malus*, *Pirus* and *Prunus* species in the years 1932-7. There were 29 *Malus* forms, including 22 varieties or hybrids, 4 *Pirus* forms, 2 *Prunus Padus*, 20 *Prunus Cerasus* including 16 varieties, and 14 *Prunus prunophora* forms including 10 varieties. Of the *Malus* forms 20 were self-sterile either absolutely or for practical purposes; 7 showed a strong or weak tendency to form fruit containing seeds after self-pollination. *M. Kaido* gave a 51.6% crop in 1936, but a comparison of the vitality and growth capacity of *M. Kaido* seedlings from selfed seed and from cross-pollinated seed was greatly in favour of the latter. The 4 *Pirus* species all proved self-sterile. The 2 *Prunus Padus* and all the *P. Cerasus* forms proved self-sterile. Of *P. prunophora* 12 proved self-sterile. One case of *P. Simonii*, in which the trials were only made one year, showed weak self-fertility. A small fruited form of *P. insititia* showed good self-fertility in 3 years' trials. Parallel trials were held in 1936 and 1937 on the value of the pollen and its germination capacity. The pollen of some *Prunus* forms was found to be sterile for all practical purposes.

60. FRISCHENSLÄGER, B. 575.18 : 634.11 + 634.13  
Versuche über den Einfluss des sortenfremden Blütenstaubes auf die Ausbildung des Fruchtfleisches bei einigen Birn- und Apfelsorten. (The effect of particular pollen on fruit consistency in pears and apples.)

*Gartenbauwiss.*, 1938, 12 : 138-44, bibl. 5.

Individual Beurré Diels and Vicar of Winkfield pears were artificially pollinated with Clapps Favourite and Glou Morceau and individual London Pippin and Ontario apple flowers were pollinated from Charlamovsky and Champagne Reinette. The resulting fruits showed appreciable differences in quality and storage capacity. Since the form of the fruit inclined predominantly to that of the pollinator, metaxenia would appear to be proved.

61. BABALEANU, P. 634.11 : 581.145.2  
Zur Frage des Fruchtansatzes beim Apfel. (Fruit set in apples.)  
*Angew. Bot.*, 1938, 20 : 453-538, bibl. 31.

It has long been known that set of fruit is partly dependent on pollination and nutrition. In the years 1937 and 1938 the author attempted to discover whether morphological and genetical factors do not also play an important part. His material consisted of several trees each of 9 well-known varieties including Belle de Boskoop, Ontario, Cox's Orange Pippin and Blenheim Orange. Particular attention was paid to the position of the flowers in the cluster. He summarizes his results as follows:—“ 1. The flowers in a cluster are of different values. This can be seen at blossoming, fruit set and after the June drop. The middle blossom is always the most important, next comes blossom 4 or 5 and then 3, 6 and 2 in that order. 2. Early removal of the middle blossom, as also of the weak blossoms 2, 6 and 7, results in improved flowering, fruit set and cropping of the others. This shows that the differences noted cannot be attributed to an inherent tendency to fruit formation in the organism, but that it is a matter of correlated

behaviour, which offers a problem in growth substance effect. Testing a blossom and with it a variety for its tendency to form fruit by removing 4 stigmas was shown to be unsuitable since fruit set depends on chromosome complement. Fruit set of blossom with only one stigma is very small in triploids, less than 50% of that of fully fertilized blossoms, but in diploids it is much greater and nearly equal to that of blossoms with 5 stigmas. 4. A more abundant pollination is essential for fruit formation in triploid varieties. 5. The determination of the fruit set : blossom complement ratio showed the tendency of the variety as regards fruit set. This, quite independent of the chromosome complement, is certainly a varietal character. The determination of the above mentioned ratio proved to be the only suitable method by which to test the character of any varieties as regards fruit set. 6. It was also possible to determine the cropping tendencies of different varieties. 7. Finally it may be noted that fruit drop at the two normal periods of fall is also a varietal character.

*Growth and nutrition.*

62. MÄDE, A. 551.566 : 634.23  
Ein Beitrag zum Mikroklima eines Obstbaumes. (A note on microclimate in  
a fruit tree.)

*Gartenbauwiss.*, 1938, 12 : 127-37, bibl. 3.

Records were taken of the air temperature in cherry blossoms at Geisenheim and at Müncheberg under varying conditions of weather, i.e. overcast or sunny, and of the effect on it of position on the tree, i.e. whether on north or south side. Laboratory experiments with cut branches were also made. The effect of an outside position causing rapid loss of heat is noted. On sunny days the temperatures inside the blossoms were appreciably higher than those outside during most of the day, but this difference was not so marked on dull days.

63. ZORIN, F. M. 634.13 : 581.145.2  
A pear which produces fruits vegetatively.\* [Russian.]  
*Vernalization*, Moscow, 1938, No. 3 (18), pp. 91-6.

Rumour has been busy these last few years with a so-called vegetative pear which is said to produce its fruits from leaves and is obtainable somewhere in Russia. We are therefore very grateful for this short article which gives the facts soberly and without raising any claims as to the marvellous usefulness of the said pear. In fact, although a most interesting phenomenon its economic interest would appear to be nil. The physiologist, however, cannot but wonder, and attempt to discover the cause of the phenomenon. The Sochi Research Station has discovered and investigated 3 so-called vegetative pear trees on the Black Sea coast. Two of them were found not to bear sufficiently typical vegetative fruits and were discarded. The third at Tuaps is the subject of the present article. The scion, variety unknown, was grafted some 10 years ago on to wild pear stock at 1.5 m. above ground level, after which operation the tree appears to have been neglected and to have produced numbers of suckers which were left. The crown is meagre but far reaching and arched, and there is very little additional branch growth. The leaves are round with rather triangular ends, some of them with even, others with finely toothed margins; the leaf nervature is fine. This tree produces 3 types of fruit, (1) ordinary, (2) semi-vegetative and (3) vegetative. About three weeks after normal blossoming a second blossoming occurs. In this only a small proportion of the flowers are normal, the rest showing imperfectly developed corollas, stamens and pistils. Many of these imperfectly formed flowers then form fruits without any pollination having taken place, or in fact having been possible, and the fruit forms by the swelling of the calyx; leaves are often attached to these abnormal flowers and in such cases form part of the fruit. The fruit thus formed is then a sort of combination of vegetative and reproductive organs. Simultaneously with the formation of these semi-vegetative fruits can be noted the growth of the true vegetative fruits on some of the smaller branches. They develop as follows. A shoot ending in a single leaf and bud grows through a rosette of

\* Full translation available.

expanding leaf petioles just above it to form a true vegetative fruit. Normally developed dormant buds are found in the axils of these fleshy leaf petioles just as in the axils of leaves of ordinary shoots and have been successfully used for budding. Sometimes the fruit is formed merely by the expansion of the leaf petioles, which may number 3, 4, 5, 10 or more. Sometimes the leaf petioles and leaves expand together, in which case the tips of the leaves look like a calyx at the top of the fruit. Sometimes the appearance of a vegetative fruit is such as to suggest 2 or 3 fruits all growing out of one another. For propagation purposes some 17 true vegetative fruits were produced on and taken from the tree in 1935 together with almost every twig showing any suspicion of producing such fruit, despite which the phenomenon was again very noticeable in 1936 and 1937. Such fruits become fairly large, 6 cm. long and 4.5 cm. across, and may resemble normal fruits in shape, though most are unmistakably different, as described above. They ripen about a fortnight after the others and taste just the same. Bud wood taken from the shoots showing the phenomenon has now been successfully worked on quince and on pear and the resulting growth will be closely watched. The causes of this strange metamorphosis are briefly discussed but without any conclusion being reached.

*Soils, manures and cultural practice.*

64. OSKAMP, J. 634.1/7-1.4  
**Soils in relation to fruit growing in New York. XII. Tree behaviour on important soil profiles in the Peru, Plattsburg and Crown Point Areas in Clinton and Essex Counties.**  
*Bull. Cornell agric. Exp. Sta. 705*, 1938, pp. 27, bibl. 13.  
 The orchard soils examined in the Champlain Valley fruit section are fundamentally similar to those found in other New York fruit areas. Certain differences, however, were found to exist. One of the most obvious soil-orchard relationships in the Champlain Valley is the presence of a very compact unweathered glacial till which apple tree roots do not penetrate to any extent. In some few cases bedrock is the obstructing agency. In certain small areas of approximately level topography, with a well-developed grey layer due to waterlogging, many trees were missing and poor orchard conditions were observed. Deep, light-textured sandy soils with subsoils containing less than 5% humus showed very little root development in the subsoils. Many trees were missing, and poorly developed trees prevailed. The largest and thriftiest trees with the deepest roots were found in soil profiles having a fairly uniform texture and brown colour, usually bright and uniform but sometimes with slight greyness and mottling.

65. ELLENWOOD, C. W., AND GOURLEY, J. H. 634.11-1.51  
**Cultural systems for the apple in Ohio.**  
*Bull. Ohio agric. Exp. Sta. 580*, 1937, pp. 33, bibl. 6.  
 The chief systems of soil management in use in Ohio are sod, tillage with cover crops, mulch and intercropping. Various modifications and combinations of these systems are also used. This is a study of the effects of some of these different methods upon the soil and trees, in the course of which the following conclusions were reached:—Any soil programme in the orchard which is definitely soil depleting, either through cropping or erosion or both, is destructive in the long run. Clean cultivation, inadequate green manure crops, failure to manure and possibly to lime would all fall in this category. On the other hand, a system would be soil conserving or neutral if the orchard were kept in bluegrass or other non-leguminous sod and manured in such a way as to balance any normal loss of nutrients from the soil. Lastly, a system should be classed as soil building, where there is a net gain in organic matter and improvement in soil tilth and the common nutrients are replaced in an increasing ratio. Such a system would be one of strongly growing cover crops. This would usually mean the use of a complete fertilizer over the orchard area at least every 2 or 3 years, the use of lime on acid soils, and the additional use of nitrogenous fertilizer or manure beneath the trees each year. Even with these precautions it is of doubtful

value on hilly land where erosion occurs. Another system is sod mulch or grass mulch with the use of lime and chemical fertilizers or manures as needed.

66. YOCUM, W. W. 634.11 : 581.144.2

**Root development of young Delicious apple trees as affected by soils and by cultural treatments.**

*Res. Bull. Neb. agric. Exp. Sta.* **95**, 1937, pp. 55, bibl. 56.

Young Delicious apple trees were grown in clay loam and loess soils in Eastern Nebraska under varying cultural conditions. The development of roots and tops was studied for the first 3 years after transplanting in the case of 73 trees which were excavated for the purpose. For the first 2 years normal rainfall was recorded on clay loam orchards and a deficit of over 9 inches each year on loess orchards. The third year (1934) was one of severe drought and heat in both localities. The total rainfall deficiency for the 3 years was 30.8 inches on loess orchards and 11.3 on clay loam orchards. The development of root systems was extremely rapid, the roots reaching a maximum depth of 8.8 and a lateral spread of 12 feet in the first year, and 14.8 feet and 21.2 feet in the second. During the third year the maximum lateral root spread was 29.4 feet and the maximum depth 17 feet. This greatly exceeded the lateral spread of 3-year-old tops which averaged 6 feet, and the height of the trees which was 7.8 feet. The root systems responded readily to changes in soil environment. Under clean cultivation the roots penetrated deeply and spread widely. In competition with maize there was little lateral spread and most of the root growth was vertical. Under straw mulch the roots had a pronounced shallow, lateral development. Under sod mulch both tops and roots were dwarfed. No change in the development of roots and tops was attributable to the use of the fertilizers, ammonium sulphate and acid phosphate, except for slight injury due to sulphate in the first season. Maize planted 7 feet from the trees had little effect, but when planted closer it resulted in decreased root development. The average spread of roots of cultivated trees in loess soil was 15.5 feet after 2 years of growth. The average spread of the roots of trees at the end of the third season was 19.2 feet. The most distinct difference between the root systems of trees under cultivation and those affected by competition with maize was the wide spread of roots of cultivated trees at great depths. The trees in the mulched series grown in clay loam all showed a marked lateral development of roots (23.6 feet) in contrast to those grown in loess (19.2 feet), but their vertical development was not so extensive (9.4 feet as compared with 14.7 feet). There was a definite positive correlation between top growth and root growth in trees in the mulched series in clay loam. Trees in loess soil did not show so obvious a correlation. Apple tree roots grew towards an adjacent optimum moisture supply. The response of the root systems to the various cultural treatments is attributed to variations in water content and its location in the soil. Straw mulch caused more water to be available in the upper 2 to 3 feet of soil. Here roots had a marked lateral development but vertical growth was less than under other treatments. Maize greatly reduced the soil moisture on each side of the tree row and tree roots turned downwards as they approached this drier soil. After 3 years of growth apple trees on loess soil had absorbed about half the total available moisture present in the soil directly beneath the trees to a depth of 9 feet. [From author's summary.]

67. BECKER, J. 634.1/8-1.8

**Die Untergrunddüngung im Obstbau. (Manuring by soil injection.)**

*Ernähr. Pfl.*, 1938, **34** : 252-4.

For previous accounts of the use of the fertilizer lance for manuring see *H.A.*, 1 : 347, 3 : 301, 4 : 189 and 4 : 587. The present article does not appear to add anything to the previous accounts, though illustrations of the process are given. The operation is carried out by a so-called lance (made by Holder Bros. of Metzingen, Württemburg) which is attached to an ordinary motor sprayer and driven into the ground at whatever interval seems suitable, about  $\frac{1}{2}$  gallon of fertilizer solution being injected at each point.

68. MEIER, K. 634.1/2-1.8  
 Düngeversuche mit Obstbäumen. 1. Mitteilung. (Manurial trials with fruit trees. 1st report. Observations on the effect of lime on the Ontario apple worked on E.M. IX stock and growing in a light, acid soil.) [German and French summary.]

Reprinted from *Landw. Jb. Schweiz*, 1938, pp. 312-38.

The experiments which were initiated in 1931 are still in progress. They are being carried out in Prodrorit (a concrete composition) cylinders containing soil of known physical composition to which known quantities of K, P and N were added in all cases. In 7 cylinders no lime was added, in 6 cylinders lime in the form of calcium carbonate was added to the extent of 1% of the contents and in 7 cylinders it was added to the extent of 6%. Considerable detail is given on the technique employed and on the changes in pH, calcium carbonate content, etc. Illustrations are provided of the general appearance of the bushes under the three different treatments, of the root growth, of individual leaves and fruits, from which it is clear that whereas the addition of the smaller quantity of lime was highly advantageous that of the larger amount did more harm than good. The lesson to be learned is that liming may be necessary but should not be undertaken haphazard. Liming should be preceded by a soil examination as to pH, carbonate content and, if possible, P and K content. Not only the top layer, i.e. 0-30 cm., but also the 30-60 cm. layer needs examining and differences in soil from tree to tree must not be forgotten. It would appear from these experiments that apples prefer a soil to be slightly acid and it is suggested that, quite apart from the composition of the soil, rootstocks play an important role in determining manurial requirements.

69. BLANGSTEDGAARD. 634.1/7-1.8  
*Frugttraeforsag og Gødningsforsøg.* (Fruit tree research and manurial investigations.)  
 Printed for Forsøgsstationen Blangstedgaard ved Odense by Andelsbogtrykkeriet i Odense, 1938, pp. 77.

A general map and a few smaller sketches of the Blangstedgaard station's orchards are given. The plots are numbered and the varieties of fruit grown on them are listed. The nature of experiments conducted on the different plots is noted, more detailed accounts being given of manurial trials. Investigations include apples, pears, quinces, plums, damsons, cherries, peaches, vines, blackberries, gooseberries and vegetables. No results are given.

70. DICKSON, G. H. 634.11-1.8  
 Some results of mineral fertilizers on apple seedlings.  
*Sci. Agric.*, 1938, 19 : 105-9.

Although the addition of a potassium fertilizer (muriate of potash) in most cases definitely improved the appearance of the foliage of seedling apples showing leaf scorch in Ontario, cases occurred in which the improvement was only temporary and the deficiency was found to be an expression of some deeper trouble often connected with soil texture. The possibility of this should always be investigated before the use of potassium fertilizers can be advised to hasten the recovery of trees affected with leaf scorch.

71. MARANI, M., GOIA, G., AND GERBALDI, C. 634.25-1.542  
 Influenza di alcune pratiche culturali (applicazione di cinti e potatura lunga) sulla fertilità di piante di pesco "Bonvicini". (The effect of banding and long pruning on fertility in the Bonvicini peach.) [English, French and German summaries.]

*Riv. Frutticoltura*, 1938, 2 : 241-51, bibl. 5.

The suggestion previously made by the same authors (*Ibidem*, 1 : 225, *H.A.*, 8 : 37) that hope of inducing better fertility in the Bonvicini peach lies in long pruning and other cultural methods has been followed up. Metal bands were applied tightly round the trunk in August 1936 and were kept there throughout 1937. They caused strangulation and a notable swelling of the

trunk just above them. They were removed in 1938 before the fruit ripened. The crop was checked and it was found that the number of fruits was increased by 21.18% and the total weight of fruit by 9.88% as compared with that from the control trees. On the other hand the trees were obviously much exhausted by the process, some of them being badly attacked by gummosis and all being particularly badly infested by aphids. These deleterious effects would appear to preclude the normal use of the practice. As regards pruning, long pruning was found to result in a much larger crop than short pruning and it is, therefore, recommended for this variety.

72. NEUBAUER, H. F. 631.542.24 : 634.1/2 : 581.192  
Der Einfluss der "Ringelung" auf den Kohlehydratgehalt der Blätter. (The effect of ringing on the carbohydrate content of leaves.)  
*Gartenbauwiss.*, 1938, 12 : 23-31, bibl. 18.

Ringing was carried out above and below the junction of the leaf stalk with the stem in a number of deciduous trees including apples, peaches, cherries and Japanese quince and the effect on the carbohydrate content of the leaves was studied. It was noticeable that if the operation was carried out in the morning there was little if any difference in carbohydrate content of the leaves of ringed and unringed twigs the same evening. But the following morning, whereas in leaves of the ringed twig the carbohydrate content remained more or less constant, in those of the unringed twig the content of fermenting sugars had decreased by about 50%. The good effect of ringing on blossom formation and fruit set is attributed to the fact that the buds on the ringed branches have always a larger concentration of carbohydrates at their disposal without having to build them up afresh each day as in the case of buds on unringed branches.

#### SMALL FRUITS, VINES, NUTS.

73. SLATE, G. L. 634.7  
New or noteworthy fruits. XII. Small fruits.  
*Bull. N.Y. St. agric. Exp. Sta.* 680, 1938, pp. 18.

Four red, three black and two purple raspberry, one currant and four strawberry varieties, most of which originated at the New York agricultural experiment station, are described here in considerable detail.

74. MORTENSEN, E. 634.75  
Strawberry varieties in southwest Texas.  
*Bull. Tex. agric. Exp. Sta.* 556, 1937, pp. 32, bibl. 13.

The strawberry is extensively grown in southwest Texas, where it is produced under irrigation, the plants being reset each autumn and the crop harvested the following winter and spring. Between 1932 and 1937 some 70 varieties and strains were studied at Winter Haven, Texas, with regard to the following characters:—(1) runner plant production, (2) heat resistance, (3) shipping quality, (4) season of ripening, (5) colour, (6) frost resistance, (7) yields, (8) disease resistance and (9) dessert quality. As a result Missionary (Carolina strain), Klondike, Ettersburg 80 and Banner are recommended for commercial plantings.

75. SHASHKIN, I. N. 634.7  
Notes on *Actinidia*. [Russian.]  
*Sci. Fruitgrowing, Mitchurinsk*, 1938, No. 5, pp. 49-51.

Recent research has shown that *Actinidia* berries contain large quantities of vitamin C. Moreover, it has been found that bisexual *Actinidia* flowers only produce non-viable pollen, that only the flowers with one stamen such as grow on male plants give viable pollen and that, therefore, male vines are indispensable, if the plants with female flowers are to set fruits. In this article the author gives a brief account of his study of *Actinidia* spp. in the Far East in 1937.

The following are the more important points :—*Species*.—3 *Actinidia* species have been found to be indigenous to the Far East, one of which bears berries containing large amounts of vitamin C. The second species produces berries suitable for making high quality wines, is large-fruited and has certain other desirable characteristics. The berries of the last species are scarcely edible, but on the other hand no shedding of the berries occurs and the plants of this species are resistant to pests. *Breeding and selection*.—Observations showed that no natural hybridization takes place between *Actinidia kolomicta* and *Actinidia arguta*, since they flower at different times. *Actinidia polygama* has almost the same flowering date as *A. arguta*, but no natural hybrids have so far been discovered. *Artificial pollination*.—Of all the crosses made in the Taiga only *Actinidia kolomicta* was found to set fruit and seed when pollinated with *Actinidia arguta*. This confirms results obtained at the Mitchurin nursery in 1935 and 1937. During the expedition 9 wild *Actinidia* forms were collected. At present these are being propagated by cuttings at the Mitchurin nursery where the study of *Actinidia* is to be carried on. *Growth habits*.—*Actinidia kolomicta* (apparently the same holds good for the other forms.—ED.) requires much light, and moist and well-drained soils, rich in leaf mould. Grown on open spaces, especially on south and east slopes, the plants suffer severely from scorching of the shoots. The yields from wild *Actinidia* for certain areas have been estimated as high as 1 ton per ha. (as compared with 2·5 tons at the Mitchurin nursery).

76. LEBEDEVA, S. P. 635.61 : 631.541.11 : 635.624  
**Changing the nature of plants [melons] by grafting.** [Russian.]  
*Nov. sel. Khoz, Moscow*, 1937, No. 16, pp. 42.

Grafting has made possible the spread of melon cultivation from the subtropics to Moscow. Suitable stocks are essential. The following results of grafting were established :—(a) alteration in time of ripening, (b) increased flowering induced by grafting on pumpkins, (c) female flowering in scion increased by increase in flowering of stock, (d) yield of ripe fruits on scion increased by presence of 1-2 fruits on the stock, (e) habit of fruiting changed from secondary to primary shoots and hence earlier fruiting obtained by use of a suitable stock such as *C. maxima*, (f) better rooting in pumpkin as result of grafting with melon, (g) earlier fruiting in grafted pumpkins. Moreover the following practical conclusions were drawn :—By grafting melons on pumpkins the yield from the ground not only is a melon crop of up to 17 tons per ha. obtained but also from the same area a pumpkin crop of up to 40 tons per ha. Melons grafted on pumpkins ripen some 10-19 days earlier than otherwise. Fruits from grafted melons have a better flavour and show a sugar increase of 12-14%. The life of the melon plants grafted on pumpkins is appreciably longer than that of ungrafted melons both under shelter and in the open. Grafting on pumpkins on excessively wet soils can prevent neck rot. The results of grafting on the progeny are as follows :—better seed quality, increased percentage of successful grafts, earlier maturity, higher yields, hardier plants more resistant to diseases.

77. TAYLOR, J. K., AND HOOPER, P. D. 631.471 : 634.1/8-1.67  
**A soil survey of the horticultural soils in the Murrumbidgee irrigation areas, New South Wales.**  
*Bull. Coun. sci. industr. Res. Aust.* **118**, 1938, pp. 109 + 9 maps.

A general description of Murrumbidgee irrigation areas and their geographical position is given. The soils of the areas are discussed and analytical data examined. Of the particular fruit crops grown, grapes covered the greatest area in 1935, followed closely by citrus, chiefly oranges. Peaches and apricots were also grown on a large scale.

78. BIOLETTI, F. T. 634.851  
**Outline of ampelography for the vinifera grapes in California.**  
*Hilgardia*, 1938, **11** : 227-93, bibl. 15.

The methods and characters most suitable for use in a horticultural classification of the vinifera grape varieties are discussed with special reference to the needs and conditions of California vineyards.

79. HUSFELD, B. 634.836.72+634.836.75  
Wichtige Kreuzungsergebnisse bei der Rebe. (Important breeding results  
with the grape vine.)

Züchter, 1938, 10 : 291-9, bibl. 17.

The author considers briefly early attempts to breed vines, which should be resistant to *Phylloxera vastatrix* and to *Plasmopara viticola*. He enumerates the phenomena found in the vines as the result of monofactorial cleavage, dihybrid cleavage and polyfactorial cleavage and considers the possibility of breeding resistant strains.

80. SCHERZ, W. 634.836.75  
Zur Immunitätszüchtung gegen *Plasmopara viticola*. (Breeding vines immune  
to *Plasmopara viticola*.)

Züchter, 1938, 10 : 299-312, bibl. 9.

The methods used at Müncheberg for the production of *Plasmopara*-resistant vines are described. No evidence has been adduced to show that different specialized strains exist. Trials indicate that immunity genes probably occur in *Vitis vinifera* and that their existence may be proved in the course of the present investigations.

81. CAPUCCI, C. 634.8-1.542-1.55  
Fertilità delle sottogemme di alcuni vitigni coltivati nelle colline dell'Imolese.  
(Fertility of the secondary shoots of certain vines grown on the hills near Imola.)  
[English, French and German summaries.]

Riv. Frutticoltura, 1938, 2 : 253-71, bibl. 18.

The experiments described here are in continuation of those previously reported *Ibidem*, 1938, 2 : 89, *H.A.*, 8 : 1014, the particular aim on this occasion being to determine whether and how the fertility of secondary shoots is connected with the chemical composition of the vine at the time of pruning. The direct producer Jacques was found to possess plenty of fruitful secondary shoots, whereas in the European varieties tested the fruitfulness of the secondary shoots ranged from very good to nil. To ensure a maximum crop from the secondary shoots it was essential to prune in April. The weight of grape bunches borne by these shoots decreased in proportion as pruning was delayed beyond this time. Grapes on the secondary shoots generally ripened a few days later than the others. The branches were found to be richer in carbohydrates than the corresponding bud shields. In the author's opinion this was due to the active absorption of these substances by the new shoots. The carbohydrates in branches and bud shields of the varieties examined decreased gradually from 15 April to 17 May. Whereas the total N and the protein N content of the branches decreased slowly during this period, the decrease in soluble N was at first very similar to that of total and protein N but later became much faster, probably owing to the urgent necessity of the plant for building up new tissues. The decreased fruitfulness found in shoots springing from the secondary shoots following the suppression of the main shoot later than the month of April is presumably connected with the gradual decrease in nutrient substances found in the branches of the varieties examined.

82. VOLK, A. 634.8-1.8  
Einfluss von Ernährung und Wasserversorgung auf Holzreife und Wurzelbil-  
dung der Rebe. (The influence of nutrition and water supply on the maturity  
of the wood and root formation in grape vines.) [English summary ½ page.]

Ernähr. Pfl., 1938, 34 : 338-46, bibl. 19.

In 1926-33 fertilizer trials were conducted on grape vines in pots at the Bonn Institute of Plant Diseases. The material used was young selected budded plants of Moselle Riesling. The deficiency symptoms appeared in the order N, P and K. Nitrogen deficiency was characterized *inter alia* by a weak development of the whole plant, small, pale, deeply indented leaves and a brick-red anthocyanin colour along the midribs and stems of the leaves and on the young shoots. P deficiency was shown by lack of growth, larger dark green leaves and violet-red anthocyanin colouring matter on the leaf stems. In the case of potassium deficiency the leaves were at first

dark green and little indented; later they tended to curl up at the margins while the whole blade assumed a convex appearance. Finally the well-known necrosis of the leaf tissue became visible. Anatomical investigations of the cross-sections of the vines indicated that in the case of N excess, K deficiency and particularly of P deficiency maturity was retarded in autumn so that the youngest internodes remained immature. Conclusions drawn may be summed up as follows:—K deficiency is particularly insidious as it can impair wood formation and retard general maturity before becoming apparent. P deficiency may expose the plant to damage from inclement weather by prolonging the vegetative period into late autumn and may increase the risk of injury from late frosts by inducing a tendency to form new shoots very early in the spring. Excess of N may result in luxuriant growth, its effect on the actual growth period of the vine being similar to that of P deficiency. The unfavourable ratio of medullary to lignified tissue in the vine, produced by excess of N, becomes still less favourable when the supply of moisture is limited. Thus heavy applications of N must only be given in sheltered, warm sites and on deep moist soils. N deficiency must also be avoided, since the use of heavy P and K dressings over long periods without any N produces the same injury to the vine root system as P and K deficiencies. For the production of healthy, vigorous and heavy-bearing vines a well-balanced fertilizer is required.

83. QUIN, D. G. 634.87

**Table grapes; a review of the Australian export industry.**

*J. Dep. Agric. Vict.*, 1938, 36 : 541-4.

Some notes of horticultural interest are included in this report. A falling off in production of the table grape Ohanez in the irrigated areas of N.S.W. and Victoria after the seventh or eighth year is attributed to the absence of flower bunches, an effect to be expected where plants of strong root growth are subjected to heavy pruning and low trellising. It has been found that yield can be restored and increased by the substitution of overhead trellising 7½ feet high. This has the effect of not crowding the pruning canes and of admitting plenty of light and air while the grapes which underhang the foliage are protected from the blemishes caused by sun and wind. Root pruning by subsoiling is effective when conditions do not justify high trellising. To secure the best keeping results grapes should be packed in medium or fine (but not very coarse) cork on the field and precooled as soon as possible. 32° F. is the best storage temperature for grapes. Sawdust is superior to cork packing in many ways but the difficulty has been to find a local wood that will not taint the fruit.

84. BARNARD, C., AND THOMAS, J. E. 634.8-1.547.4/5

**Fruit bud studies: The sultana. IV. Methods of forecasting yield.**

*J. Coun. sci. industr. Res. Aust.*, 1938, 11 : 151-9.

In vines of average or sub-normal vigour, bud fertility, i.e. the percentage of fruitful shoots developed, forms a basis on which forecasts of yield may be made with considerable accuracy 5-6 months in advance. With very vigorous vines, however, low bud fertility may be compensated by an increased bunch size and by greater sugar development in the berries. In these cases the forecasts may be less reliable. A method for forecasting 12 months in advance is suggested in which the basis of the estimate is the amount of crop matured during the previous season, suitable allowance to be made for any undue loss of potential crop which occurred during that season. The article is an interim report of investigations proceeding at the Research Station, Merbein.

85. THOMAS, J. E., AND BARNARD, C. 634.8-1.547.4/5

**Fruit bud studies: the sultana. V. The stabilization of yield in the Mildura district.**

*J. Coun. sci. industr. Res. Aust.*, 1938, 11 : 159-68.

Suggestions based on experimental evidence for stabilizing the annual yield of the sultana are:—(1) Pruning so that the potential crop each season approximates to the carrying capacity of the vines. Methods for estimating both of these are described. (2) Increasing the leaf/fruit

ratio by light pruning and partial disbunching. The number of bunches removed should be such that those remaining should produce a crop equal to the carrying capacity of the vines. The actual carrying capacity of the vines is raised by the increased leaf/fruit ratio.

86. BURRIER, A. S., AND SCHUSTER, C. E. 634.54  
**Cost and efficiency in the filbert enterprise in Oregon.**

*Sta. Bull. Ore. agric. Exp. Sta.* 351, 1937, pp. 60.

Some 98% of all the filbert trees of the U.S.A. are grown in Oregon and Washington and cover an area of 11,000 acres. In 1937 only about a quarter of these trees were in full bearing. Filbert orchards normally increase in productiveness up to at least 10 years of age. There were insufficient data to draw any conclusions on productiveness of trees over that age. Yields appeared to be but little influenced by spacing of the trees in the field or by the practice or absence of fertility-upkeep operations. The soils in most of the orchards studied possessed high natural fertility. Since expenses remained about the same the per acre value of the bearing orchard was found to increase as the yield per acre increased. Efficiency in labour organization differed greatly. Some improvement in this, especially as regards harvesting, appears possible.

#### PLANT PROTECTION OF DECIDUOUS FRUITS.

87. CORNFORD, C. E. 634.1/7-2.111 and 551.524.371 : 551.584  
**Katabatic winds and the prevention of frost damage.**

*Quart. J. roy. met. Soc.*, 1938, 64 : 553-87, bibl. 20.

Winds are known as katabatic winds, literally winds which go downwards, when caused by the gravitation of cold air off high ground. Such winds are also referred to sometimes as downhill or valley winds. The author summarizes this very readable account of his experiments to date as follows :—"A new instrument for recording air movements of low velocity and air temperature fluctuations, and a portable anti-radiation screen, suitable for a grass minimum thermometer, are described. Experiments are described showing that certain conditions must be fulfilled in making a just comparison between the air temperature in an orchard-heated plantation and in an unheated plantation. Observations of air currents on hillsides on radiation nights are presented, which show that two winds exist, the 'hilltop' wind and the katabatic wind. The effect of each on the other in certain localities is described. It is shown that the hilltop wind is able, on the higher part of a slope facing it, to push uphill the air in the first 10 ft. or so above the ground, and at a lower level to neutralize the force of the katabatic wind, producing a calm belt on the slope. Experiments designed to demonstrate the magnitude of air temperature differences caused by differences in the vegetative cover of the soil alone, by differences in altitude alone and by a third unknown factor, are described. Evidence is presented showing that when a katabatic wind moves down a slope its temperature does not necessarily decrease. It is indicated how the new information may be applied to the problem of preventing frost damage to crops."

88. CORNFORD, C. E. 634.1/7-2.111 and 551.524.371 : 551.584  
**Some meteorological factors affecting the distribution of frost damage to fruit trees. I.\***

*J. Pomol.*, 1939, 16 : 291-319, bibl. 21.

The cumulative effect of the recommendation from the Agricultural Section of the Conference of Empire Meteorologists in 1929, the severe frosts of May 1935 and the resolution adopted by fruitgrowers at a Conference on Frost Damage held at East Malling in September 1935 resulted in a grant from the Ministry towards the scientific investigation of the cause and prevention of frost damage to fruit and crops. In this paper the author reports on the preliminary work. In simple language, for which one is grateful, and with the help of photographs and diagrams he discusses the meteorological phenomena which affect the incidence of frost and how they may

\* See previous abstract.

possibly be used to prevent it. He summarizes as follows:—"On nights when the air is not too humid, when the sky is clear and it is calm in the valleys, a light breeze of relatively warm air, called in this paper the hill-top wind, has been found on hill-tops. The breeze is able to influence the direction taken by a katabatic\* wind. The hill-top wind is even able, on the higher part of slopes facing it, to push the air uphill, and at a lower level to counterbalance or neutralize the force of the katabatic wind and thus produce a calm belt on the slope, called here the neutral zone. When the hill-top wind blows on a sloping field in a direction at right angles to the contour lines the katabatic wind moves underneath the hill-top wind in the opposite direction; but when the hill-top wind blows obliquely on a sloping field the katabatic wind is deflected by it and the air in the neutral zone moves along the contours. The effect of these two winds on each other in certain other places is described. The possibility of utilizing the hill-top wind for the avoidance of frost damage on relatively high land is suggested. A knowledge of the conditions affecting the direction of katabatic winds makes it possible to say where the air is likely to be sufficiently calm for orchard heating to be effective. The differences in air temperature at a height of 3 feet above the ground, caused by differences in soil cover, that occur on some radiation nights in orchards and other fields have been investigated. The lowest minimum temperatures occur over grassland. The air above bare soil, and that in woods with a complete leaf canopy, is relatively warm, often 6° F. above that over grassland at a height of 3 feet above the ground. Since vegetation influences air temperature it was necessary to eliminate this variable factor when studying the influence of altitude on air temperature. In this way it was shown that in undulating country the air temperature varies with altitude on most radiation nights, the highest places being the warmest. On some radiation nights, however, the reverse was found, showing that other factors, at present unknown, may influence air temperature. It has been demonstrated that when a katabatic wind moves down a valley or a slope its temperature does not necessarily decrease, but is largely determined by the vegetation over which it passes. It is suggested that in certain orchards containing long grass exposed to the sky in the blossoming period the danger of frost damage may be reduced by reducing the amount of exposed grass. Experiments in micro-climatology and with orchard heaters showed that certain conditions must be fulfilled in making a just comparison between the air temperature in a heated plantation and that in an unheated one. It should be emphasized that the investigation reported here is far from being complete. Until a great deal more becomes known no precise recommendations for the prevention of frost damage can be made."

89. MANARESI, A. 632.111 : 634.11 + 634.13  
 Una conseguenza poco nota delle brinate primaverili del 1938 sulle pere e sulle mele. (A little known effect of the spring frosts of 1938 on pears and apples.)  
 [English, French and German summaries.]  
*Riv. Frutticoltura*, 1938, 2 : 229-40, bibl. 7.

The author describes with illustrations the damage done to pears and, to a smaller extent, apples, by the continued spring frosts of 1938 in the Romagna district of Northern Italy. The damage consisted in smaller or greater russety areas in which portions of the skin between the broadest part of the fruit and the calyx lost their green colour and became russeted and corky in consistency. In some cases a depressed ring was formed round the fruit. It is thought that the damage sometimes attributed in the past to spraying may have really been due to late spring frosts.

90. LOEWEL, E. L., and HAAS, P. G. 634.23-2.111  
*de*  
 Beobachtungen über die Wirkung des Frostes auf Kirschblüten und Kirschertrag im Alten Land 1938. (Notes on the effect of frost on cherry blossom and crop in Altenland 1938.)  
*Gartenbauwiss.*, 1938, 12 : 263-72.

Very early blossoming of cherries in the Altenland district near Hamburg in 1938 was followed by late frost. The crop exceeded estimates made immediately after the frost. Careful observations

\* See previous abstract.

both then and afterwards led to the following conclusions:—The varieties which were in full bloom were damaged most, while both those which had already bloomed and those which were not yet in bloom suffered least. The stage of blossoming was a more important factor than any varietal frost susceptibility. Counts established the fact that even after a loss of 75-85% an average fruit set was attainable provided a proportionately higher percentage of the blossoms which remained set fruit. As a guide to the estimate of crop based on a percentage of damaged blossoms it may be said that some 10% of all blossoms must set fruits in order to assure an average crop.

91. WILCOX, J. C. 634.11-2.19  
**Effects of some field plot treatments on drought spot and corky core of the apple.**

*Sci. Agric.*, 1938, 18 : 300-14, bibl. 7.

Field plot treatments continued for 6 years in the attempt to find a cure for drought spot and corky core of the apple are here described. The following results are reported:—Deficient irrigation water resulted in decreased vigour and increased drought spot and corky core. The application of 15-20 lb. fertilizer per tree per year resulted in the case of ammonium sulphate in a more vigorous growth and more severe drought spot, of superphosphate in a slight increase in drought spot and in muriate of potash in increased drought spot. No type of pruning had any appreciable effect on drought spot. Tree crowding lessened both vigour and drought spot. Significant negative correlations were established between drought spot and percentage bloom and positive ones between drought spot and tree vigour, the last possibly being concerned with nitrogen.

92. ASKEW, H. O., THOMPSON, R. H. K., AND CHITTENDEN, E. 546.273.33 : 634.1/8-1.4  
**Effect of borax top-dressing on boron status of soil and fruit.**

*N.Z. J. Sci. Tech.*, 1938, 20 : 74A-8A, bibl. 1.

Surface applications of borax have penetrated into the soil to a depth of at least 30 in.; after three years the boron content of the soil in the main root zone was maintained at a level at least twice as high as that on the control areas. In each of the three seasons the boron content of fruit from the top-dressed areas was appreciably greater than that of the control fruit. A single application of borax at the rates discussed in this paper has proved effective in the control of internal cork for at least three seasons. In view of the loss of borax from the soil as a result of leaching by rain, it is possible that small annual applications may prove more economical than larger periodic applications. [Authors' summary.]

93. ATKINSON, J. D. 546.27 : 634.11-2.19  
**Residual effect of boron soil dressings on internal-cork of apples.**

*N.Z. J. Sci. Tech.*, 1938, 20 : 90A-1A.

Soil dressings of boron compounds, minimum  $\frac{1}{4}$  lb. per tree, applied to the soil surface to a radius of 6 ft. from the trunk, controlled internal cork in apples for the first two years but began to prove ineffective with the Washington and were completely ineffective with the Sturmer variety in the third year in New Zealand.

94. BORESCH, K. 634.721-2.19 : 631.8  
**Über die Blattrandkrankheit der Johannisbeere mit einem Ausblick auf die Entstehung von Mangelchlorosen. (Leaf scorch in currants with a note on the origin of chlorosis deficiencies.)**

*Gartenbauwiss.*, 1938, 12 : 176-233, bibl. 84.

Field manurial experiments were carried out for 6 years on Dutch red currants growing in a poor soil. Known amounts of fertilizers were given in different forms and the incidence of chlorosis, leaf scorch and other physiological disease phenomena noted. Yearly doses of 65g. K<sub>2</sub>O per bush in the form of K<sub>2</sub>SO<sub>4</sub>, KNO<sub>3</sub>, K<sub>2</sub>HPO<sub>4</sub> entirely stopped leaf scorch but the result of continued manuring with KCl was the appearance of symptoms so similar to those of ordinary leaf scorch as to make it appear that no fertilizers at all had been given. The same amount of Cl in the form of NH<sub>4</sub>Cl was not so injurious. Ammonium salts resulted in a dark green coloration

of the leaves, whereas the use of nitrate had not quite so pronounced an effect. Sodium salts applied in the absence of K salts could be classed in the following order according to increasing degree of harmful symptoms noted,  $\text{SO}_4 > \text{NO}_3 > \text{Cl}$ . On certain currants the ill effects of KCl manuring were checked by ammonium salts. In pot experiments the ill effect of KCl was not quite so evident, at least where the chloride was not present in large amounts. Where chloride was given in quantity it resulted in a form of leaf chlorosis, in the appearance of brown necrotic spots a little way from the edge of the leaf and finally in brown shrivelling of the leaves and death. When large amounts of chloride were given the cations in decreasing order of harmful effect were  $\text{Na} > \text{Ca}, \text{NH}_4 > \text{Mg}$ . At high salt concentrations, especially of sulphates, a fine flecking of the leaves occurred and they dried up before their time. In pot experiments the addition of  $\text{NH}_4\text{NO}_3$  to KCl applications largely prevented damage being done and in smaller doses this combination even aided growth. In these experiments Cl damage became evident earlier and in a more acute form than K deficiency symptoms. Leaf scorch incidence was definitely correlated with K content of the leaf. The critical point for this symptom comes when the K content of the whole leaf is a little less than 1% of the dry weight and the symptoms become more pronounced the lower the K content falls below this point. At the time of autumn tints the K content may or may not be lower than this limit. Determinations of K and Cl content in healthy and Cl-damaged leaves show that the chlorosis due to the chloride occurs when the equivalent relation of  $\text{K}/\text{Cl} < 1$ , as for instance in a leaf where the proportion of K ions to Cl ions is 100 : 130. Leaf scorch is probably due not to the water balance of the leaf being upset by K deficiency or to the immobilization of iron but much more likely to the photo-oxidative destruction of the chlorophyll caused by the emptying of the assimilation apparatus. The leaf tissue thus damaged goes brown and dies.

95. BAWDEN, F. C. 632.8

**Some recent work on plant viruses.**

*Emp. J. exp. Agric.*, 1939, 7 : 1-10.

This paper gives a general account of the nature and properties of plant viruses and the diseases that they cause. The relationships between viruses and insect vectors are discussed and possible means of controlling the spread of disease in the field described. Serological work with plant viruses has given much useful information and the precipitin test provides a very rapid means of testing for the presence of a virus. Virus-infected plants have yielded protein preparations which are highly infective. Differences in degree of crystallinity of these nucleoproteins are probably due to differences in the size and shape of the virus particles and these have been studied by various physical methods. The bearing of these results on modern theories of the nature of viruses is briefly discussed. It seems a pity that no bibliography accompanies this interesting paper.

M.E.K.

96. CHAMBERLAIN, G. C. 634.711-2.8

**Yellow blotch curl ; a new virus disease of the red raspberry in Ontario.**

*Canad. J. Res.*, 1938, 16 : 118-24.

A distinct virus attacking Cuthbert red raspberry in Canada is described. The symptoms are a loose type of curling and pale chlorotic foliage sometimes showing yellow blotching and a ring spot. The disease was not recognized as such until 1935 and has only been found in the field on Cuthbert. It is transmissible by grafting to several other red varieties including Lloyd George but with black varieties this has so far not been possible.

97. SCHMIDT, M. 632.42 : 634.11

*Venturia inaequalis* (Cooke) Aderhold. VIII. Weitere Untersuchungen zur Züchtung schorfwiderstandsfähiger Apfelsorten. Erste Mitteilung. (*V. inaequalis*. VIII. Further investigations on the breeding of scab-resistant apple varieties. A first report.)

*Züchter*, 1938, 10 : 280-91, bibl. 17.

The author describes in some detail the methods used at Müncheberg between 1933 and 1938 in an endeavour to produce scab-resistant apple varieties. There are now available a large number

of seedlings, some of which are scab-resistant but none of which have yet yielded fruit. A general discussion of the work brings to light the following points:—Breeding for immunity in fruit trees is particularly difficult for the following reasons: 1, shortness of flowering season and its dependence on weather; 2, impossibility of producing genuine F2 generation owing to self-sterility; 3, considerable rarity of resistant genotypes; and 4, length of time necessary before new crosses fruit. The inheritance of scab resistance is very complicated and depends on the influence of a large number of genes. To illustrate this, of three F1 seedlings from *Malus micromalus* × Charlamovsky all were resistant, and yet when *M. Zumi* was crossed with Winter-gold Pearmain and with Danziger Kantapfel all the seedlings were susceptible, some of them giving rise to resistant varieties on being crossed with susceptible forms. One great advantage to the breeder in this particular instance is that at least he has definitely resistant forms on which to base his work. But a disadvantage is that the small fruitedness and high tannin content of these forms appear to be dominant, and a second disadvantage lies in the large number of degenerate, useless forms produced. In this connexion reference is made to the fact that the vast majority of forms produced by Macoun when breeding for hardiness were small-fruited. That there are many specialized strains of *V. inaequalis* should not be forgotten; it is even suggested as a possibility that all forms found resistant so far might fall victims to other forms of scab than those they have so far encountered. In future supposedly resistant strains will be planted out in a number of different districts and thus submitted to the attacks of many different strains.

98. LOEWEL, E. L., AND FRIEDRICH, G. 634.11-2.42  
Fusikladiumbeobachtungen an eingetüteten Apfelzweigen während der Vegetationsperiode. (Notes of scab infection on covered apple branches during the growing period.)

*Gartenbauwiss.*, 1938, 12: 121-6, bibl. 11.

The authors describe their first year's experiments to determine the origin of the initial scab infection in apple trees in the Jork district near Hamburg. It was found that covering apple branches at the time when the flight of ascospores was greatest did not result in any decrease in scab infection. The experiments are to be continued.

99. DEARNESS, J., AND FOSTER, W. R. 634.11-2.42  
*Coniosporium* disease of apples and crab-apples.  
*Canad. J. Res.*, 1938, 16, Sec. C., pp. 274-6, bibl. 3.

A new species of *Coniosporium*—*C. Mali*—parasitic on the crab apple and several varieties of the common apple, is described. The symptoms of the disease, both on the foliage and the fruit, are similar to those produced by *Fusikladium dendriticum*. Therefore, *Coniosporium* scab is suggested as the common name. [Authors' summary.]

100. MOORE, M. H. 634.15-2.4  
Leaf blight in the medlar.  
*Gdnrs' Chron., Lond.*, 1938, 104: 440-1, bibl. 9.

The second recorded occurrence in England on medlar of *Entomosporium maculatum* Lev., long known as the cause of leaf blight on quince and pear, is described.

101. ZUBOV, M. 634.8-2.411  
Copper-organic preparations for controlling *Plasmopara viticola* on grapes.  
[Russian.]  
*Zashch. Rast. Vredit.*, 1937, No. 12, pp. 174-6.

In the search for sprays to control mildew on vines, which contain smaller amounts of copper than bordeaux and yet have an equally toxic effect, two copper-organic preparations, designated as ANT and BNT, were tried in 1934-5 at the Jemet State Farm (Black Sea Coast area). Both preparations applied at the strength of 1.5% were found highly toxic and gave better mildew control than 1% bordeaux mixture. Copper-organic preparations did not cause scorch injury

of the leaves, and, moreover, gave a considerable reduction in metallic copper as compared with 1% bordeaux mixture. Further investigations should prove valuable.

102. LATVIA, FOREST DEPARTMENT. 632.3/7  
 Pārskats par kaitekļu un slimību izplatību Latvijas valsts mežos 1936/37 g.  
 (Note on the spread of the tree pests and diseases in Latvian forests in 1936/37.)  
 [Lettish, French summary 15 lines.]

Reprinted from *Latvijas mežu statistika* 10, 1938, pp. 15.

Records taken for the period 1927-37 show that the most serious damage done to trees in Latvia was due to the insects *Melolontha* sp. and *Hylobius abietis*. Of the fungi *Lophodermium Pinastri* Chev. was the most important. Control measures against these and other pests and diseases are described briefly.

103. MISEROVA, A. M. 634.1/7-2.3/7  
 Pests and diseases in the orchards of Sverdlov area. [Russian.]  
*Sci. Fruitgrowing, Mitchurinsk*, 1938, No. 5, pp. 57-61.

This is a preliminary list of some 40 pests and diseases attacking various fruits in Central and Northern Ural.

104. SHEVCHENKO, M. I. 631.521.5 : 537.531  
 Revealing seed pests by means of X-rays. [Russian, English summary  
 33 lines.]  
*Zashch. Rast. Vredit.*, 1937, No. 14, pp. 14-25.

Radiographical seed tests were made at the Leningrad District Quarantine Laboratory of 33 plant species which were attacked by 20 different pests. Soft X-rays and Bucky's adjacent rays with a wave length ranging from 0.4 to 2.5 Å were employed. The results may be summed up as follows:—By X-raying pea seeds injured by the pea weevil, *Bruchus pisorum* L., it was possible to detect any adult insects inside the seeds. Tunnels and cavities containing larvae of the pea weevil could also be discovered by X-raying pea pods infested under laboratory conditions. This radiographical analysis of pea seed immediately after harvest is thought to have certain advantages over the unsatisfactory method of staining the seed in 1% iodine solution in potassium iodide. Radiographs of bean seeds injured by the bean weevil, *Acanthoscelides obsoletus* Say., showed not only the beetles, pupae, and mature larvae, but also the tunnels of larvae of earlier stages. In a small percentage of infested seeds the tunnels of 4-day-old larvae were disclosed, while those of 10 to 12-day-old larvae could be found in 58.2 to 100% of infested seeds. Injuries to cotton seed by the pink bollworm, as well as the caterpillars themselves, were clearly seen in the radiographs. Radiography of bird-cherry seed and the discovery in the latter of *Furcipes rectirostris* larvae show clearly how this method facilitates and improves the accuracy of the process of entomological examination of similar hard seeds. Further, by means of radiographic analysis living *Megastigmus aculeatus* larvae were discovered in seeds of roses. The method saves time and labour, thus by radiography one worker can analyse 10,000 cotton seeds per day, while he can only analyse 2,000 by opening them. The X-ray dosage absorbed by the seeds during the examination does not affect their viability.

105. MICHELBACHER, A. E. 632.656  
 The biology of the garden centipede *Scutigerella immaculata*.  
*Hilgardia*, 1938, 11 : 55-148, bibl. 236.

The paper forms a very full study of the biology of the garden centipede *Scutigerella immaculata* (Newp.) in California. Under field conditions flooding appears to be the most effective method of control; in the greenhouses raised benches, steam treatment or soil fumigation may reduce its depredations.

106. MASSEE, A. M., AND GREENSLADE, R. M. 632.6/7

**The fauna of the weevil "sack-band" — III.**

*Ann. Mag. nat. Hist.*, 1938, ser. XI, 1 : 607-10, bibl. 9.

The authors record recent additions to the list of insect species found in sackbands in 1935, 1936, and 1937. The total species found up to date amount to two hundred and sixty. Previous lists were given *Ibidem*, ser. X, 1 : 317-20, and ser. X, 16 : 350-4.

107. HILDEBRAND, A. A. 634.75-2.753 : 581.144.2

**Notes on the strawberry root aphid and the effects of its feeding punctures on strawberry roots.**

*Sci. Agric.*, 1938, 19 : 95-104, bibl. 16.

*Aphis forbesi* Weed was found recently to be fairly prevalent in the commercial strawberry plantations of central and southern Ontario. Root rot was also often present on infested plants. No direct causal relationship between insect injury and the disease could be traced. Injury caused to aphis-infested plants probably arises from a reduction of the water supply and solutes, to interference with translocation and to disturbances of metabolic equilibrium rather than to direct injury to plant tissues by the insect's method of feeding. Eggs have been discovered at a depth of several inches in the soil which implies that ants may not be solely responsible for the appearance of nymphs on the roots in spring.

108. SERDYUKOV, P. 634.11-2.753 : 632.96

**Results of widespread distribution of *Aphelinus mali* as a means of *Eriosoma lanigerum* control in North Caucasus.** [Russian.]

*Zashch. Rast. Vredit.*, 1937, No. 13, pp. 69-71.

*Aphelinus mali* gave 80-95% control over *Eriosoma lanigerum* in 2-3 years, and, under particularly favourable conditions, in 1 year after its introduction to the infested orchards in Northern Caucasus. 100% control has not been obtained in any of the orchards under observation. The advantages of biological control are said to be the following: 1. It reduces the cost of labour required for chemical treatments and dispenses with the cost of chemicals. 2. It results in increased yields and stimulates tree growth.

109. PRINZ, V. I. 634.836.72

**The changes in virulence of *Phylloxera* biotypes.** [Russian, German summary pp. 1½.]

*Zashch. Rast. Vredit.*, 1937, No. 12, pp. 137-42.

As a result of research work carried on for some time in U.S.S.R. the following conclusions were reached:—1. *Phylloxera* resistance of vines varied with the soil types. 2. Two *Phylloxera* biotypes were established in Kakhetia. 3. The virulence of *Phylloxera vastatrix* biotypes was found to change on transfer from one type of rootstock to another. 4. *Phylloxera* strains developing for prolonged periods (15-20 years) exclusively on European vines were found incapable of producing galls on American vines. The ability of such *Phylloxera* strains to produce galls only returned when they had developed on the roots of American vines for a prolonged period.

110. BREIDER, H., AND HUSFELD, B. 634.836.72

**Die Schädigung der Rebe durch die radicole Form der Reblaus. (The injury of grape vines caused by the root form of *Phylloxera vastatrix*.)**

*Gartenbauwiss.*, 1938, 12 : 41-69, bibl. 15.

Infection trials showed that no definite conclusions can be drawn from initial injury of the grape vines as to the subsequent behaviour of the variety as regards *Phylloxera*. In some varieties root growth is greatly checked by parasitism by the root form, in others it is affected very little or not at all. The signs of injury are noted and the experimental results are examined from a breeding standpoint.

111. CHUGUNIN, Y.A.V. 634.11-2.78  
**Testing pyrethrum as a control for codling moth.** [Russian.]  
*Zashch. Rast. Vredit.*, 1937, No. 13, pp. 73-5.  
 The efficacy of pyrethrum in the control of codling moth was tested at the Gul' collective farm (Crimea). In each of three separate trials five Sary-Synap apple trees were used, three further trees serving as controls. The number of apples affected by the codling moth was considerably reduced on treated trees (477 fruits per tree as compared with 911 fruits on the controls). Mixing pyrethrum powder with paraffin proved a successful method of preparing pyrethrum emulsions. Further trials on a large scale are advocated in which certain other objectives would have to be included and particularly the testing of pyrethrum as a means of control against sucking insects.

112. WADLEY, F. M. 634.11-2.78  
**The eastern tent caterpillar.**  
*Leaf. U.S. Dep. Agric.* 161, 1938, pp. 4.  
 In this leaflet the life history and habits are described of *Malacosoma americana* (F.) which causes serious damage to various fruit trees and ornamentals in U.S.A., particularly in the North-Eastern States. Natural checks on this caterpillar are dealt with briefly and insects sometimes mistaken for it are noted. Control measures recommended consist of spraying, destruction of tent caterpillar nests and removal of wild cherry trees, which are the favourite hosts of this insect.

113. VIKTOROV, V. F. 635.615 : 632.7  
***Etiella zinakinella* Fr. as a pest of water melons.** [Russian.]  
*Zashch. Rast. Vredit.*, 1938, No. 16, pp. 108-10.  
*Etiella zinakinella* which has been hitherto known solely as a pest of leguminous plants, was found to attack water melons, particularly of the Melitopol'sky variety, in the neighbourhood of Saratov.

114. STEPANTSEV, I. N. 632.654.2 : 551.5  
**A prognosis of the rate of development of the red spider, depending on meteorological conditions.** [Russian.]  
*Zashch. Rast. Vredit.*, 1938, No. 16, pp. 22-6, bibl. 4.  
 The author has worked out a special "bioclimatic" formula of meteorological data, through which integral co-efficients of a climate may be obtained permitting estimation of the distribution and the rate of increase of the red spider in that area.

115. MASSEE, A. M. 634.1/8-2.76  
**Coleoptera associated with cultivated fruits.**  
*Trans. Soc. Brit. Ent.*, 1938, 5 : 223-34, bibl. 6.  
 In this article on the incidence of fruit tree Coleoptera in the south of England such beetles are considered as actually feed on the foliage or fruit, or bore into the wood or stem as well as a few predacious insects.

116. WIESMANN, R. 632.77 : 634.23  
 Untersuchungen über die Lebensgeschichte u. Bekämpfung der Kirschfliege, *Rhagoletis cerasi* L. III. Mitteilung. (**Life history and control of the cherry fruit fly, 3rd report.**) [French and German summaries.]  
*Landw. Jb. Schweiz.*, 1936, pp. 811-57, bibl. 23.  
 Das Wirtspflanzenproblem der Kirschfliege. (**Problems of the host plants of the cherry fruit fly.**) [French and German summaries.]  
*Ibidem*, 1937, pp. 1031-44.  
 Die Orientierung der Kirschfliege bei der Eiablage. (**The orientation of the cherry fruit fly during laying.**) [French and German summaries.]  
*Ibidem*, 1937, pp. 1080-1109, bibl. 18.  
 The author continues his studies on *Rhagoletis cerasi*, the cherry fruit fly. In the first of the above articles his observations during the 1934 season are recorded. Under Swiss conditions it is

found that the fly attacks cultivated and wild cherries and fruits of certain *Lonicera* species, namely *L. xylosteum*, *L. tartarica*. These species are, however, not thought to be of great importance in keeping the pest alive. Observations made at the time of egg-laying on the orientation of the fly during the process shows that the combination of two actions can be distinguished; a phototelotactic orientation in the flight to the cherry and a tigmotactic and kinesthetic orientation during actual egg-laying on the fruit. Olfactory and chemotactic stimulation plays no part.

117. BECKER, W. B. 632.7 : 635.977.8 : 581.144.4

**Leaf-feeding insects of shade trees.**

*Bull. Mass. agric. Exp. Sta.* 353, 1938, pp. 83, numerous bibliographies.

Illustrated descriptions and notes on incidence and control are given with regard to some 40 odd insects or mites which feed on the leaves of shade trees in Massachusetts. A note is also given of damage done by brown and grey squirrels. References to other literature on the subject are given in nearly every case.

118. SIMMONDS, J. H. 632.952

**Fungicides.**

*Qd agric. J.*, 1938, 49 : 604-22.

The nature, properties and uses of a large number of the more generally used fungicide materials are discussed.

119. VEITCH, R. 632.951

**Insecticides.**

*Qd agric. J.*, 1938, 49 : 584-603.

The nature, properties and uses of a large number of the more generally used insecticide materials are discussed.

120. BORDEN, A. D. 634.1/7-2.951.8

**Oil sprays for deciduous fruit trees by the tank-mixture method.**

*Circ. Calif. agric. Exp. Sta.* 345, 1938, pp. 15.

Information given in the article "The tank-mixture method for dormant oil spraying of deciduous fruit trees in California" originally published in *Bulletin 579* is presented here in condensed form. Considerable new data increase the value of this publication.

121. DMITRIEV, A. K. 632.95

**A new sulphur preparation "E".** [Russian, English summary 13 lines.]

*Zasch. Rast. Vredit.*, 1938, No. 16, pp. 90-5, bibl. 6.

In this article a full description is given of a new sulphur acaricide, designated here as "E" preparation. Its toxicity and chemical tests in the laboratory have been successful.

122. SHAW, H., AND STEER, W. 632.951

**Studies on the toxicity of certain nitrophenols, thiocyanates, naphthalene derivatives and organic bases to the eggs of some common orchard pests.**

*J. Pomol.*, 1939, 16 : 364-88, bibl. 30.

The ovicidal properties of 44 organic preparations, most of them chemically individual substances, have been investigated in the laboratory, using as test objects the eggs of the vapourer moth (*Orgyia antiqua* L.), the green apple aphid (*Aphis pomi* De Geer), the winter moth (*Operophtera brumata* L.), the fruit tree red spider (*Oligonychus ulmi* C. L. Koch), and the apple sucker (*Psyllia malii* Schmidt). The preparations were mainly dinitrophenols, thiocyanates, naphthalene derivatives and organic bases. 3 : 5-dinitro-o-cresol, n-dodecyl thiocyanate (lauryl rhodanate),  $\beta$ -butoxy- $\beta'$ -thiocyanodiethyl ether and nicotine were the most toxic and the first named was

outstanding. Wherever sufficient data were available, attempts have been made to correlate differences in toxicity with modifications of molecular structure. The four materials mentioned were further tested in field trials on plum trees infested with leaf-curling plum aphid (*Anuraphis padi* L.) and hop-damson aphid (*Phorodon humuli* Schr.), and largely bore out their laboratory promise. The mechanism of the ovicidal action of nicotine is discussed in some detail. [Authors' summary.]

123. IVANOVA, N. A. 632.951.8  
**Methods of testing the effectiveness of mineral oils on the eggs of the apple sucker, *Psyllia mali*.** [Russian, English summary 20 lines.]  
*Zashch. Rast. Vredit.*, 1937, No. 14, pp. 69-72.

Experiments carried out in the Voronezh District, U.S.S.R., showed that crude oil emulsions did not stop the development of the germs in *Psyllia mali* eggs, and, therefore, did not destroy the eggs themselves but created conditions under which the hatched larvae perished. It is thought that crude-oil emulsions softened the egg shells and thus impeded the normal hatching of the larvae; it takes a great deal of effort for the larva to hatch from such eggs, and most of them die from exhaustion. Some of them are killed when at the time of hatching they come into contact with the oil residue on the plants and eggs. The author concludes that counting hatched and unhatched eggs is not a sufficiently reliable method for testing the effectiveness of an emulsion as an insecticide and therefore she recommends the method of quantitative measurement of infestation by pest survivors of plants sprayed with emulsions as well as of controls.

124. HOSKINS, W. M., AND BEN-AMOTZ, Y. 632.951  
**The deposit of aqueous solutions and of oil sprays.**  
*Hilgardia*, 1938, 12 : 83-111, bibl. 21.

Using a standard surface of beeswax as the solid sprayed and a standard method of spraying a study was made of the relations between concentration of blood albumin, haemoglobin or sodium oleate and the following properties: amount of the aqueous solutions and of the necessary substance deposited in the absence of oil; deposit of oil, of aqueous phase, of accessory substance, and of all components when emulsions were used; ease of wetting of wax by solutions of the accessory substances and by the entire emulsion; replacement of aqueous phase by oil; and stability of the emulsions. The amount of oil deposit can be explained at least qualitatively as follows:—When only oil and water are present the emulsion wets poorly and drops roll on the surface with a minimum area of contact. Addition of a protein promotes wetting and opportunity for oil to reach the surface. Hence deposit is increased until formation of large sheets of the aqueous phase upon the surface and resistance to displacement of the aqueous phase by oil lead to a decrease in oil deposit with higher concentration of protein. Soap promotes wetting so little that a corresponding increase in oil deposit does not occur. With all three accessory substances, the increase in stability of the emulsions diminishes oil deposit. Water-soluble substances follow the aqueous phase and increase spreading of oil only after the water has evaporated. [From authors' summary.]

125. HALLER, M. H., CASSIL, C. C., MURRAY, C. W., BEAUMONT, J. H., AND GOULD, E. 634.11-2.951.23  
**Removal of lead spray residue from apples grown in the Shenandoah-Cumberland Valley.**

*Tech. Bull. U.S. Dep. Agric.* 622, 1938, pp. 32, bibl. 21.

In 1934 and 1935 a study was made in Maryland and West Virginia of the methods for removal of spray residue on apples and of such factors as are likely to influence the amount and ease of removal, namely variety, size and maturity of the fruit, the growth conditions of the tree, weather conditions during the growing season, and thoroughness and time of application of sprays and lastly the spray materials used. The interrelation of the factors involved is brought out by the results noted, which are here fully discussed.

126. ELLENWOOD, C. W., MORRIS, V. H., AND SILVER, E. A. 632.95 : 634.11

**Removal of spray residue from apples.**

*Bull. Ohio agric. Exp. Sta.* 584, 1937, pp. 40, bibl. 17.

An account is given of washing apples in the under brush flood type washer using 1 to  $1\frac{1}{2}$ % acid solution to remove lead arsenate residues. This type was found efficient especially when the washing solution was heated. The flotation type though generally satisfactory was less efficient. The mechanical brush was not found satisfactory. Washing did not injure the keeping quality of the fruit.

127. BÖTTCHER, F. K. 632.951.1 : 638.12

Untersuchungen über den Einfluss von Pflanzenschutzmitteln auf die Bienen.  
II. Die Wirkung des Nicotins auf die Bienen. (The effect of pest control on bees. II. Nicotine.)

*Gartenbauwiss.*, 1938, 12 : 234-62, bibl. 10.

In previous articles the author has shown the danger to bees of highly concentrated arsenical dusts. He has also shown that in the concentrations normally used the ordinary spray materials containing copper or iron salts and sulphur do not present a serious danger. In the present article he considers nicotine in its different forms and concentrations and concludes that as dust or spray at concentrations of 2.5 or 0.5% it is not dangerous to bees.

128. C.A.S.B.\* 016 : 615 + 632

**Miscellaneous references on insecticides and fish poisons of vegetable origin.** Being some 260 references to articles on insecticides and fish poisons, 1938, (stencilled).

129. WOODS, J. J. 632.693.2

**Trapping moles.**

*Publ. Dep. Agric. Canada* 622, 1938, being *Circ.* 133 and *Revis. Circ.* 67, pp. 4.

No system of mole control has proved as satisfactory as trapping. The author recommends the type of trap known under the trade name of English mole trap. This trap has been extensively used on the Agassiz experimental farm and has proved satisfactory in every way.

### VEGETABLE GROWING, STIMULANTS AND FIBRES.

130. EFFERSON, J. N. 635.35

Economic studies of vegetable farming in New York. IV. Production and marketing of cauliflower in Delaware County, 1936.

*Bull. Cornell agric. Exp. Sta.* 701, 1938, pp. 45

and 635.52

Economic studies of vegetable farming in New York. V. Production and marketing of lettuce in Oswego County, 1936.

*Bull. Cornell agric. Exp. Sta.* 702, 1938, pp. 41.

The various points in the production and marketing of the two vegetables in the two respective counties in 1936 are considered in these bulletins entirely from an economic standpoint.

131. NATSENTOV, D. I. 631.544

**Heated glasshouses and hotbeds on the state and collective farms in U.S.S.R.†**  
[Russian.]

*Fruits and Vegetables, Moscow*, 1938, No. 10, pp. 31-8.

The glasshouses and hotbeds of usual Russian type are described here in some detail. Notes are given on their construction, use and scope. The heat is given by either sun or rotting

\* Central Agricultural and Scientific Bibliography, Science Museum, London S.W.7.

† See also 207.

organic matter, stoves and central heating, or air heaters, electricity and lastly, in industrial areas, by industrial wastes in both liquid and gaseous form.

132. ROWLAND, F. E. 631.588.1 : 631.544  
**Electric soil-heating.**

*Emp. J. exp. Agric.*, 1938, 6 : 179-87, bibl. 3.

The copper conductor of the modern soil heating cable is insulated with heat-resisting materials such as asbestos yarn and oil-impregnated paper. Over this is a lead sheath to exclude moisture and give mechanical protection and this is protected from corrosion by jute braiding impregnated with bituminous compound. The cables are supplied in England in lengths of 25 ft., 100 ft. or 150 ft., with loading wattage of 125, 490 and 700. The cables are now normally laid direct in a bed of sand, pipes proving expensive and a source of drip. The best way to construct a bed is to dig a pit sufficiently big for the bed to be lined at the bottom and round the sides with at least 1 ft. of ash, coke or similar heat-insulating material. A layer of sand about 2 in. deep is then placed in the bottom and the cable laid in it. Soil is added, the depth varying around 6 in. One of the great advantages of the system is temperature control which can be achieved by means of a thermostat. It is suggested that considerable price concessions may be obtainable from electricity suppliers if the load is disconnected during the hours when the normal load is at its height. As soil is a good heat retainer such a practice should be possible. Brief notes are given in this article on the progress of electric soil heating in Sweden, Holland and Germany and of its use at one or two centres in England. Figures are also given of the present financial aspect of the system as determined by the Department of Ornamental Horticulture, Cornell, and the Missouri Agricultural Experiment Station, as also of rather more financially encouraging results from Cleveland.

133. FRIMMEL, F. 633.43-1.523  
**Karottenzüchtung. (Carrot breeding.)**  
*Züchter*, 1938, 10 : 181-5, bibl. 7.

The author discusses the principles which must govern any selection and breeding experiments with carrots which are in this article classified into the following types according to their roots. Valery, i.e. the type nearest the wild form; Duwicker, type with blunt, stump shaped root; Nantes, type with cylindrically shaped root; and Parisian or round rooted type. He considers that only by crossing the Nantes with the Parisian type can progress be made.

134. WHITCOMB, W. D. 633.43-2.77  
**The carrot rust fly.**

*Bull. Mass. agric. Exp. Sta.* 352, 1938, pp. 36, bibl. 24.

Various cultural recommendations are made for the control of the carrot rust fly, *Psila rosae* Fab., and with regard to insecticides the following recommendations are made:—Treatment of early crop carrot seed with powdered calomel, mixing  $\frac{1}{2}$  lb. with 1 lb. of seed just before sowing. If economy allows, for early carrots make three applications of derris or cubé-clay dust containing at least 0.6% rotenone at  $\frac{1}{2}$  lb. per 100 ft. at weekly intervals or three applications of naphthalene flakes using 1 lb. per 100 ft. For late carrots make four applications of naphthalene flakes or, more cheaply, ground tobacco containing 1-1 $\frac{1}{4}$ % nicotine at 2 lb. per 100 ft. or Scotch soot at 3-4 lb. per 100 ft.

135. CANADA (H. S. ARKELL). 633.491-1.532.2  
**Canadian seed potatoes in South American countries**, Ottawa, 1938, pp. 12.

This is an expert's report on the scope for Canadian seed potatoes in Argentina, Uruguay, Brazil, Chile, Peru, Ecuador, Bolivia, Columbia, Venezuela, Panama and Costa Rica and Cuba.

136. C.A.S.B.\* 016 : 633.491-1.8

***The manuring of potatoes.***

Being 267 references to articles on manuring of potatoes, 1938, (stencilled).

137. OBERMAYER, E. 633.842

Der ungarische Gewürzpaprika, sein Anbau und seine Züchtung. (**The breeding and cultivation of the Hungarian red pepper or paprika.**)*Ernähr. Pfl.*, 1938, **34** : 247-52, bibl. 9.

Paprika, which is an important horticultural crop in Hungary, was introduced there by the Turks. In 1934, 17,500 acres were under this crop, which is grown mainly by the small farmers. It is an annual with bright red pendulous fruits. Its pungent burning taste is imparted to it by the alkaloid, capsaicin, which it contains. It is particularly rich in vitamin A. An average crop yields 40 cwt. of fresh or 8 cwt. of air-dried pods per acre or about 540 lb. of ground pepper. The application of a complete fertilizer increases yields considerably. It is propagated by slips which are set in carefully prepared beds. The harvest takes place from August till the frosts come. Research is being carried out on paprika production at Szeged and Kolocsa and lately attempts are being made to produce a variety free from alkaloids which will yield a capsaicin-free pepper.

138. HASSEBRAUK, K. 635.31 : 632.452

Über die Eignung und Bewertung von Kupferoxychlorid als Spargelrostbekämpfungsmittel sowie einige andere Beobachtungen zum Spargelrost. (**Asparagus rust and its control by means of copper oxychloride.**)*Gartenbauwiss.*, 1938, **12** : 1-16, bibl. 12.

Spraying with the "Wacker" copper oxychloride preparation gave a slight control of asparagus rust in certain cases, but its effects were too irregular to warrant its use. Field experiments in which manurial variations were tried in the attempt to throw light on the incidence of asparagus rust were unsuccessful.

139. DERMANIS, P. 635.34

Anbauversüche mit Kopfkohl bei der direkten Aussaat an Ort und Stelle und bei der Pflanzung. (**The advantages and disadvantages of transplanting cabbage plants in Latvia.**)*Gartenbauwiss.*, 1938, **12** : 17-22, bibl. 4.

140. FERGUSON, W. 632.19 : 546.27 : 635.35

**Boron deficiency in cauliflower.***Sci. Agric.*, 1938, **18** : 388-91, bibl. 2.

Experiments with Early Snowball cauliflower grown from seed at Ottawa and raised in glazed jars containing ground, washed sandstone showed the necessity of boron for healthy growth. Deficiency of boron resulted in stunting and deformation of leaves round the curd, smaller incompletely developed curds brown in colour, and the occurrence of brownish, water-soaked areas in the flesh and stalk. The presence of 0.25 p.p.m. of boron in the nutrient solution applied resulted in normal plants.

141. SCHMIDT, R. 635.52

**Lettuce growing in North Carolina.***Bull. N.C. Sta. Coll. Agric.* **319**, 1938, pp. 12.

Directions for growing lettuce in the open in North Carolina are given, together with notes on packing for market.

\* Central Agricultural and Scientific Bibliography, Science Museum, London, S.W.7.

142. SCHULTZ, H., AND RÖDER, K. 635.52 : 632.41  
 Die Anfälligkeit verschiedener Varietäten und Sorten von Salat (*Lactuca sativa* L. und *L. scariola* L.) gegen den falschen Mehltau (*Bremia lactucae* Regel).  
 (The susceptibility of different varieties and strains of lettuce to downy mildew.)  
*Züchter*, 1938, 10 : 185-94, bibl. 5.

Field experiments were carried out for 3 years at Grossbeeren to determine the resistance of several hundred lettuce varieties to downy mildew. The results are summarized by the authors as follows:—1. Important differences in susceptibility exist. There are some field resistant varieties, among them Böttners Treib, May King Treib and May King. All other cultivated varieties and the wild sorts tested are susceptible. The virulence of the attack noted was not affected by the individual origin of any variety tested. Artificial infection experiments were carried out under glass. In these older plants behaved as in the open except that they were rather more severely attacked. Young plants were throughout more susceptible than older plants. Two biological races of the fungus were used and these showed different degrees of virulence in particular varieties of lettuce. A selection experiment allowing of the choice of individuals capable of resistance was worked out.

143. VOGEL, F. 635.52 : 631.8  
 Wirkungen der Nährstoffmangel-Düngung bei Kopfsalat und Kohlrabi auf verschiedenen Boden. (Effect of nutrient deficiencies on cabbage lettuce and kohlrabi on different soils.)  
*Ernähr. Pfl.*, 1938, 34 : 229-31.

Pot experiments have been in progress since 1928 at Weihenstephan with various vegetables and other horticultural plants in sand, peat and loam soils to determine their reaction to nutrient deficiencies and their optimum manuring. In cabbage lettuce N deficiency caused leatheriness of the leaves, K deficiency badly formed heads. On unmanured soils the absence of N is generally the decisive factor checking crop production. In all three types of soil both N and P deficiencies produced marked characteristic changes in the colour of the plants. K deficiency resulted in limpness. A comparison of yields shows the necessity for liberal amounts of humus in the soil when growing lettuces. The effects of withholding the different elements are illustrated in colour.

144. TAVERNETTI, A. A., AND SCHNEIDER, J. B. 635.52  
 Head-lettuce production in California.  
*Circ. Calif. agric. Ext. Serv.* 105, 1938, pp. 48.

This circular is largely a revision of *Extension Circular* 60, "The head-lettuce industry of California" by Jones and Tavernetti, and deals, after a description of the chief United States producing areas, with the ordinary problems of large-scale lettuce production under Californian conditions. Federal and Californian standards for head-lettuce and proper packing methods are considered in detail.

145. THOMPSON, R. C. 635.52 : 575.1  
 Genetic relations of some color factors in lettuce.  
*Tech. Bull. U.S. Dep. Agric.* 620, 1938, pp. 38, bibl. 29.

The knowledge of inheritance of certain colour factors (anthocyanin, chlorophyll shade, and seed colour) in the lettuce plant is not only of value in breeding and genetic studies but is also very important for classifying and standardizing the many lettuce varieties now in cultivation. The results of the study of these colour factors are described here in full.

146. RICHARDSON, J. K. 635.53 : 632.1/4  
 Studies on blackheart, soft rot and tarnished plant bug injury of celery.  
*Canad. J. Res.*, 1938, 16, Sec. C., pp. 182-93, bibl. 18.

Experimental data supplemented by observations in the field in Ontario indicate (1) that blackheart of celery is physiological in nature, (2) that early plantings are more severely affected,

(3) that most extensive injury occurs when plants are nearing maturity, (4) that vigorous plants are more subject to attack, (5) that there is a difference in varietal susceptibility, (6) that the appearance in the field of the disease is generally preceded by a period of high humidity or of high temperature or of both. The bacterial rot *Ereiniae carotovora* which is often the sole cause of soft rot is often found also as a secondary decay in the necrotic blackheart tissues. The tarnished plant bug *Lygus pratensis* is of economic importance as a vector of soft rot. Its feeding habits also cause damage both by the mechanical injury produced by numerous punctures and by the toxic effects which seem to arise in the cells surrounding a puncture. [From author's summary.]

147. SEVERIN, H. H. P., AND FREITAG, J. H. 635.53 : 632.8 : 632.753

**Western celery mosaic.**

*Hilgardia*, 1938, 11 : 493-558, bibl. 59.

There is no specific vector of western celery mosaic but 11 species of aphids which breed on celery and 6 which do not have been found capable in California of transmitting the virus. Some facts brought out by the experimental work are: the retention of virus by wingless aphids lasted from 1 to 10 hours; while some aphids recovered the virus from infected celery before symptoms had developed in the plant, others took from 1 to 6 days after the earliest symptoms had developed. The highest percentage of infection by single winged aphids was 7% (*Aphis apigraveolens*, the celery leaf aphid) and by single wingless mature aphids 37.3% (*A. ferruginea-striata*).

148. ESSIG, E. O. 635.53 : 632.8 : 632.753

**Aphids feeding on celery in California.**

*Hilgardia*, 1938, 11 : 459-92, bibl. 43.

Eleven species of aphids, the majority introduced, are listed here as pests of celery and a number of them described. It is certain that many of them are responsible for the increasing spread of virus diseases of celery in California.

149. CURTIS, D. S. 635.53 : 632.19

**Determination of stringiness in celery.**

*Mem. Cornell agric. Exp. Sta.* 212, 1938, pp. 20, bibl. 14.

Of three methods tried for testing stringiness in celery that in which the dissected tissues were pulled straight and fastened between two padded clamps of the Schopper strength tester and then tested for strength proved the most satisfactory.

150. STALS, A. 635.54

Die Bedeutung des Anbaues von Chicorée Witloof in Belgien. (**The importance**

**of chicory growing in Belgium.)**

*Ernähr. Pfl.*, 1938, 34 : 254-5.

Some 17,500 acres are under chicory at the present time in Belgium and most of the crop is exported. In this article details are given of Belgian cultivation methods, including manuring and forcing.

151. MORRISON, G. 635.64

**Tomato varieties.**

*Spec. Bull. Mich. agric. Exp. Sta.* 290, 1938, pp. 68, bibl. 58.

Notes and in many cases full descriptions are given of 120 red-fruited, 10 yellow-fruited, 1 white-fruited and 2 husk tomato varieties commonly grown in Michigan. The common synonyms are also listed.

152. DOUGLASS, J. 635.64  
**Tomato varieties from Morocco.**  
*Agric. Gaz. N.S.W.*, 1938, 49 : 653, 668.  
 A tomato variety from Morocco, Range de Marmande, has proved suitable for growing unstaked on the Central North Coast of New South Wales where it crops heavily. It belongs to the Chinese group and is a first early-maturing variety.

153. REINHOLD, J. 635.64  
**Zur Sortenfrage in der Tomatentreiberei. (Tomato varieties.)**  
*Obst. u. Gemüseb.*, 1938, 84 : 128-31.  
 The author gives useful descriptions of the characteristics of nearly 50 tomato varieties which have already proved their value either for growing in the open or under glass. The majority are known in England.

154. REID, W. D. 635.64 : 632.314  
**Bacterial-canker of tomatoes.**  
*N.Z. J. Sci. Tech.*, 1938, 20 : 69A-74A, bibl. 17.  
 A description is given of bacterial canker of tomatoes, the causal organism being *Aplanobacter michiganense* Erw. Smith, a disease of world-wide distribution but in New Zealand not found until 1936. Control measures suggested consist of soil sterilization or replacement under glass, avoidance of replanting in infected fields in the open, destruction of diseased plants. It is also said that the spread of the disease can be greatly curtailed by breaking off instead of pinching or cutting the laterals when training the plants. Clean seed from a disease-free crop should be used since the usual methods of seed disinfection destroy only the superficial bacteria.

155. GUBA, E. F. 635.64 : 632.4  
**Tomato leaf mold as influenced by environment.**  
*Bull. Mass. agric. Exp. Sta.* 350, 1938, pp. 24, bibl. 42.  
 The environmental conditions affecting the incidence of *Cladosporium fulvum* in greenhouse tomatoes in Massachusetts are considered. It is found that the disease is epidemic between June and October, i.e. when maximum temperatures of 80° F. to 92° F. prevail, when the mean minimum inside and outside temperatures converge to a narrow difference of less than 5° F., and when there is the highest mean maximum relative humidity for the year of 94-100%. These conditions are nearly ideal for the fungus.

156. MICHELBACHER, A. E., AND ESSIG, E. O. 635.64 : 632.78  
**Caterpillars attacking tomatoes.**  
*Bull. Calif. agric. Exp. Sta.* 625, 1938, pp. 42, bibl. 32.  
 In this bulletin are given descriptions of, and control measures against, the following tomato pests : the corn earworm, *Heliothis obsoleta* (Fab.), army worms (among these the yellow-striped army worm, *Prodenia praefica* Grote), the tomato pin worm, *Gnorimoschema lycopersicella* Busck, the tomato tuber moth, *Gnorimoschema operculella* (Zeller) (*Phthorimaea*), the tobacco worm (*Protoparce quinquemaculata* (Haw.) and tomato worm, *Protoparce sexta* (Johan.).

157. MATKOVSKY, S. T. 635.656-2.768  
**New achievements in the control of *Bruchus pisorum* L.** [Russian.]  
*Zashch. Rast. Vredit.*, 1937, No. 13, pp. 83-6.  
 Commercial control of *Bruchus pisorum* L. in Ukraine can be obtained by sowing the peas twice in one year and using the fresh seed from peas sown in early spring for the sowing which is done some time between 20 June and 10 July. The fields on which the peas are sown in summer must lie fallow all through the spring till sowing time. The method is said to be effective only if practised for at least 2 years in succession.

158. LARSON, A. O., BRINDLEY, T. A., AND HINMAN, F. G. 635.656 : 632.768  
**Biology of the pea weevil in the Pacific Northwest with suggestions for its control on seed peas.**  
*Tech. Bull. U.S. Dep. Agric.* **599**, 1938, pp. 48, bibl. 21.  
 Recent research on the pea weevil (*Bruchus pisorum* L.) has brought out many new facts that may aid in explaining the inadequacy of currently recommended control measures and that indicate the possibility of more effective control through the development of new and the improvement of old methods.

159. WADE, B. L., ZAUMAYER, W. J., AND HARTER, L. L. 635.656 : 632.48  
**Variety studies in relation to *Fusarium* wilt of peas.**  
*Circ. U.S. Dep. Agric.* **473**, 1938, pp. 26, bibl. 15.  
 Over 1,000 strains of pea have been grown on wilt-infested (*Fusarium orthoceras* var. *Pisi*) soil near Fairfield, Wash., and their degrees of resistance studied over a period of years.

160. SINDEN, J. W. 635.8  
**Synthetic composts for mushroom growing.**  
*Bull. Pa agric. Exp. Sta.* **365**, 1938, pp. 27, bibl. 10.  
 In experiments made at the Pennsylvania experiment farm it was found possible to grow mushrooms successfully in artificial compost made from wheat straw and urea with the addition of wheat grain. A formula found suitable for use under Pennsylvania conditions is given.

161. McMURTREY, J. E., JR. 633.71-1.8 : 632.19  
**Symptoms of field-grown tobacco characteristic of the deficient supply of each of several essential chemical elements.**  
*Tech. Bull. U.S. Dep. Agric.* **612**, 1938, pp. 31, bibl. 13.  
 The tobacco plant manifests distinctive symptoms when the soil in which it is growing is deficient in any one of the following nutrients : N, P, K, Mg, Ca, B, S, Mn and Fe. These symptoms are enumerated and discussed.

162. FAWCETT, G. L. 633.71-2.8 : 635.64  
**La corcova del tabaco y su presencia en las plantaciones de tomates. (Leaf-spot of tobacco on tomato plants.)**  
*Circ. Estac. exp. agric. Tucumán* **60**, 1938, pp. 4.  
 A study was made of a tobacco and tomato disease commonly known as corcova (leaf spot of tobacco). The disease is found to be a virus and to be carried by *Frankliniella paucispinosa* Moul. Certain control measures are recommended, including spray treatments with sulphur, nicotine and lead arsenate.

163. EISENMAYER, W. S. 633.71-1.484  
**Some correlation in plant-tissue composition, decomposition products, and effect upon crop rotation with tobacco.**  
 Reprinted from *J. agric. Res.*, 1938, **56** : 309-16.  
 It appears that plants containing larger amounts of lignin and pentosans and having high carbon-nitrogen ratios and a subsequent low tendency to protein decomposition in soil are undesirable for tobacco rotation.

164. WICKENS, G. M. 633.71-2.8  
**I. A new and serious disease of tobacco in S. Rhodesia. II. Rosette disease of tobacco. Field observations and suggestions for control.**  
*Rhod. agric. J.*, 1938, **35** : 181-4, and *Ibidem*, **35** : 842-9, bibl. 1.  
 An aphid-borne virus disease of tobacco was first observed in S. Rhodesia in the season 1936-7. It can spread rapidly and cause serious loss. The symptoms are severe stunting of the main

stem and violent distortion of the young leaves. The vector is the common green fly *Myzus persicae*. The disease is not, it appears, transmissible by handling. It is certainly new to Rhodesia and probably new to science. II. The epidemic form seems dependant on the development of winged forms of aphis. The method of overwintering is unknown but the vector has a wide range of alternative hosts. Control in the field should take the form of frequent roguings, until the plants bear leaves fit to harvest, care being taken to destroy aphids on the rogued plants and not to scatter them. The stalks should be uprooted and destroyed as soon as possible after harvest. Large-scale sprayings and dustings are impracticable on the score of cost. Control in seed beds is dealt with elsewhere (see next abstract).

165. HOPKINS, J. C. F. 633.71-2.8

**The spraying of tobacco seed beds and control of rosette disease.**

*Rhod. agric. J.*, 1938, 35 : 760-4, bibl. 1.

Recommendations are made for controlling the aphis-borne virus disease known as tobacco rosette in Southern Rhodesia. All tobacco regrowth must be eliminated from fallows. All affected seedlings must be rogued. Clean weeding should be carried out with special attention to the small nightshade (*Solanum nigrum*, the black nightshade of the British floras) and to the false Cape gooseberry (*Nicandra physaloides*). Tomatoes, potatoes and zinnias should not be grown near the beds. The vector aphis is controlled by spraying the seed beds every five days with the usual bordeaux spray to which is added per 50 gallons  $1\frac{1}{2}$  lb. arsenate of lead, 16 fluid oz. nicotine extract (40%), and a spreader. All residual plants in the seed beds should be destroyed.

166. ALLAN, J. M., HILL, A. V., AND ANGELL, H. R. 633.71-2.4

**Downy mildew (blue mould) of tobacco : Its control by benzol and other vapours in covered seedbeds. IV.**

*J. Coun. sci. industr. Res. Aust.*, 1938, 11 : 247-53, bibl. 5.

Downy mildew (*Peronospora tabacina* Adam) of tobacco seedlings can be economically controlled by benzol, an evaporation surface ratio of 1 sq. in. benzol to 100 sq. in. of seed bed being usually sufficient. Many rather than few centres of evaporation are to be preferred. Good quality calico should be used for the seed bed covers. It will last several years, whereas poor quality material may not even be vapour proof.

167. KOKIN, A.YA. 633.71-2.8

**Physiological study of the injuriousness of common mosaic disease of [Dubec Nikitsky No. 44.—ED.] tobacco.** [Russian, English summary pp. 1 $\frac{1}{2}$ .] *Zashch. Rast. Vredit.*, 1937, No. 12, pp. 95-112, bibl. 37.

168. DENT, O. W. R., MANSON, A. D., AND TREVAINS, D. 633.791-1.8

**The relative value of organic and inorganic fertilizers for hops in Herefordshire.**  
*Emp. J. exp. Agric.*, 1938, 7 : 176-8.

The whole experimental area received farmyard manure and fertilizers in 1933, complete fertilizers in 1934, slag and potash in 1935 and farmyard manure in 1937. In addition various amounts of organic and inorganic fertilizers were given in 1935, 1936 and 1937. Results showed the use of fertilizers in addition to farmyard manure to be justified and also that inorganic fertilizers under the conditions of the experiment gave significantly greater yields of dried hops than did organic fertilizers. Moreover the preservative value of such hops was at least as good as that of hops from the organic manure plots.

169. SCHEEL, R. 633.52-1.8

**Einfluss der Düngung auf Ertrag und Faserausbildung des Flachs.** (The influence of manuring on yields and fibre formation in flax growing.) [English summary  $\frac{1}{2}$  page.]

*Ernähr. Pfl.*, 1938, 34 : 302-14, bibl. 85.

Although its growing period is comparatively short, the flax plant requires large amounts of readily available plant food. Since farmyard manure, liquid and green manures do not contain

the plant nutrients in the ratios or the forms required they tend to influence the plant's growth and the development of the fibre unfavourably. Hence, it is suggested that only commercial fertilizers should be used. *Potash* improves the quality of the crop produced and especially when used in sulphate form it promotes the yield, strength and industrial value of the flax fibres. *Phosphoric acid* has a similar good effect on the quality of the flax straw to that of potash. The diameter and length of the stalks are not increased by it nor is the elasticity of the stalks reduced. It promotes the general vigour of the plant as well as flowering and seed formation ; it may also improve the quality of the fibre. It may be applied in the form of superphosphate, basic slag or Rhenania phosphate, the choice largely depending on the lime status of the soil and the time of application. *Nitrogen* promotes primarily vegetative growth. The use of nitrogenous fertilizers even on poor soils results in higher straw yields due to a greater length and thickness of the stalks. The amount of N used will depend on the amounts of available potash and phosphoric acid present in the soil which are necessary to ensure a satisfactory quality both of straw and fibre. Nitrogen is best supplied as sulphate of ammonia, although nitrate may be used to accelerate growth in the early stages. The *lime* requirement of the flax crop is quite considerable, although there is little evident response to liming. The most favourable soil reaction for flax is within the range pH 5.5 and 7.

170. KUHLMAN, G. W., AND ROBINSON, B. B. 633.52  
**Cost and efficiency in fiber-flax production in the Willamette Valley, Oregon.**  
*Sta. Bull. Ore. agric. Exp. Sta.* 354, 1938, pp. 25.

It would appear that the only point where further economy could be practised is in the processing of flax. How to do this is not stated.

171. HENRY, A. W., AND CAMPBELL, J. A. 633.52-2.4  
**Inactivation of seed-borne plant pathogens in the soil.**  
*Canad. J. Res.*, 1938, 16, Sec. C., pp. 331-8, bibl. 2.

Certain seed-borne pathogens are inactivated to a marked degree when infested seed is sown in natural soil. The discussion here is confined to *Polyspora Lini* and *Colletotrichum Lini* which cause the browning and anthracnose disease of flax. The action appears to be due to the antibiotic action of micro-organisms of the soil.

172. BLACK, M. A., AND WOODCOCK, J. W. 635.655  
**Soya beans in New Zealand.**  
*N.Z. J. Agric.*, 1938, 57 : 293-5.

The question of the economic value of soya beans in New Zealand is examined. Although, to quote the authors, a crop from which you can make practically anything from salad oil to gum boots and which is an important foodstuff for a large part of the human race makes a powerful appeal to the imagination, it is considered that for the following reasons the growing of soya beans is not an economic proposition for their country. A soya bean product must replace a crop or annual product that is cheap or plentiful in New Zealand ; prices are not and never have been low enough to attract manufacturers in the Dominion, nor are they high enough to make it possible for New Zealand farmers to grow the crop ; the crop can only be grown in the maize districts and even there it is somewhat precarious.

173. SCHMIDT, H. 635.1/7 : 631.531.17  
*Beitrag zur Kenntnis der Wirkung von Beizmitteln auf künstlich infizierte Gemüsesamen. (The effect of pickling agents on infected vegetable seeds.)*  
*Gartenbauwiss.*, 1938, 12 : 89-115, bibl. 20.

DELONG, D. M. 635.65 : 632.754  
**Biological studies on the leafhopper, *Empoasca fabae* as a bean pest.**  
*Tech. Bull. U.S. Dep. Agric.* 618, 1938, pp. 60, bibl. 60.

Fox, D. E. 632.754  
**Occurrence of the beet leaf hopper and associated insects on secondary plant successions in South Idaho.**  
*Tech. Bull. U.S. Dep. Agric.* 607, 1938, pp. 43, bibl. 11.  
 REID, J. J., MCKINSTRY, D. W., AND HALY, D. E. 633.71-1.56 : 632.3/4  
**Studies on the fermentation of tobacco. 1. The microflora of cured and fermenting cigar-leaf tobacco, 2. Micro-organisms isolated from cigar-leaf tobacco.**  
*Bull. Pa agric. Exp. Sta.* 356, 1938, pp. 1-18, bibl. 26, and *Bull. Pa agric. Exp. Sta.* 363, 1938, pp. 18, bibl. 18.

### FLOWER GROWING.

174. OLIVER, R. W., AND WATSON, E. B. 635.976.32  
**Deciduous trees and conifers more commonly used for ornamental purposes throughout Canada.** (With a section on insect pests.)  
*Publ. Dep. Agric. Canada* 599, 1938, being *Fmrs' Bull.* 49, pp. 68.  
 The information here given is intended to help the prospective planter in the selection and care of suitable trees for the decoration of his property. The descriptive notes and tables are based on records which have been kept for a number of years at the Central Experimental Farm at Ottawa and the branch farms throughout Canada. No botanical classification or key for identification of species is given. Useful notes are included on tree surgery, and insect pests are dealt with in a special section.

175. WÓYCICKI, S. 631.535  
*Über die Art des Stecklingschneidens und der Einfluss der Sandfeuchtigkeit auf die Bewurzelung. (Factors affecting the rooting of cuttings.)\**  
*Gartenbauwiss.*, 1938, 12 : 32-40.  
 Studies are here reported of the author's experiments at Warsaw on rooting dahlia, geranium, carnation, chrysanthemum, hydrangea, and fuchsia cuttings, using cuttings with and without a heel and in sand of varying humidity. Results led him to the following conclusions:— Ordinary heelless cuttings of dahlia and pelargonium root more quickly than heeled cuttings. Carnation cuttings in which longitudinal slits were made in the base of the cutting just below the node rooted better than untreated cuttings. The presence of flower buds or wilting unfavourably affect rooting capacity. Sand of 25% water capacity proved unsuitable and resulted in the death of most of the material. Sand of 50% water capacity proved best for rooting geranium cuttings and of 75% water capacity for the remainder. Frequent sprinkling with water is helpful and cuttings sprayed thus 4 times a day rooted more quickly than those sprayed only twice.

176. DORAN, W. L. 635.9 : 631.531 : 632.41  
**Germination of seeds and damping off and growth of seedlings of ornamental plants as affected by soil treatments.**  
*Bull. Mass. agric. Exp. Sta.* 351, 1938, pp. 44, bibl. 103.  
 Results are given of experiments on the effect on damping off of soil conditions, temperature and the application of some 22 chemicals to the soil. Regulation of media and other environmental factors does not always prevent damping off, as conditions suitable for plant growth are often suitable also for growth of fungi. The following chemicals used for careful soil treatment, with special precautions in some cases, proved efficacious:—calcium cyanamide, ammonium hydroxide, formic acid, salicylic acid, acetic acid dusts (very toxic to soft wood cuttings), vinegar, pyroligneous acid. In addition a number of others were found useful and not dangerous to particular plant species.

\* See also *H.A.*, 8 : 629.

177. Dickey, R. D., and Reuther, W. 635.9 : 632.191 : 546.711  
**Manganese sulfate as a corrective for a chlorosis of certain ornamental plants.**  
*Bull. Fla agric. Exp. Sta.* **319**, 1938, pp. 18, bibl. 6.  
 Experiments carried out in Florida showed that chlorotic disorders among such ornamentals as *Bougainvillea*, *Allamanda*, *Psidium Cattleyanum* (Cattley guava), *Thunbergia grandiflora*, *Bignonia venusta* and *Agyneja impubes* can be controlled by spraying with manganese sulphate. In the case of crape myrtle, *Lagerstroemia indica* L., soil treatments with manganese sulphate were as effective as spraying the foliage with the same material.

178. Lyle, E. W. 635.937.34 : 632.4  
**The black spot disease of roses and its control under greenhouse conditions.**  
*Bull. Cornell agric. Exp. Sta.* **690**, 1938, pp. 31, bibl. 20.  
 Black spot of roses caused by *Diplocarpon Rosae* is a serious disease in many commercial rose houses, all known glasshouse varieties falling victims. Syringing of roses with water to control red spider mite is considered to be the chief cause of its spread and severity in the glasshouse. The substitution of pyrethrum-rotenone spray or a spray containing selenium appears to be the most effective means of controlling the disease. The application of sulphur in dust form was only partially efficacious in preventing its incidence. Neither hand picking infected leaves, nor circulating the air by fans to disperse high relative humidity round the leaves, a condition which favours infection, was successful, and additional manure had no effect on the resistance of the plants to the disease.

179. Zinn, F. 635.939.183 : 631.523  
**Die Genetik der Blütenfüllung bei *Petunia hybr. hort.* und die Züchtung allgefüllter Kultursorten. (The genetics of double floweredness in petunia and the breeding of double flowered varieties.)**  
*Gartenbauwiss.*, 1938, **12** : 273-321, bibl. 6.  
 The genetic factors involved in double floweredness in petunia are discussed and notes are given which should help the practical breeder to produce types showing this character.

180. Vogel, F. 635.937.17 : 631.8  
**Wirkung der Nährstoffmangel-Düngung bei *Hortensia*. (The effect of nutrient deficiencies on hydrangea.)**  
*Ernähr. Pfl.*, 1938, **34** : 231-3.  
 The author gives the results of 10 years' observations on nutritional experiments at Weihenstephan with the hydrangea var. Helge. The plants were grown in a mixture of peat soil 3 parts to 1 part sand. The paper is illustrated in colour. Plants receiving NKP produced thrice the number of flowers produced by unmanured plants and twice those which received either NP or NK only. In the unmanured and the P-deficient plants the colour of the flowers was poor. Liberal N and P manuring appears to be essential for a satisfactory development and appearance while K must be given to prevent lack of size and number of flowers and general limpness. This lack of rigidity in K-deficient plants is very noticeable.

181. Gruber, F. 635.939.516 : 631.523  
**Das Auftreten recessiver Gene bei Artbastarden von *Antirrhinum*. (The occurrence of recessive genes in hybrids of *Antirrhinum* species.)**  
*Züchter*, 1938, **10** : 312-7, bibl. 7.

182. KIRTON. 635.944  
**Bulb experiments.**  
*Rep. Kirton Exp. Sta. Lincs. for 1936, 1938?*. The Guardian Press, Boston, Lincs., 1s. 3d.  
 An account is given of the work with various bulbs carried out in 1936 at the Kirton Experimental Station, Lincs. *Cultivation and forcing experiments*.—Reports are made of investigations which include the following: Depth of planting tulips; effect of cutting flowers on bulb; date of boxing for early flowering; date of housing for early flowering; forcing of bulbs lifted before and when ripe. *Varieties of daffodils*.—Details of growth performance of some 200 varieties are given together with notes on the forcing experiments now in progress. *Hot water treatment of narcissus bulbs*.—The influence of storage temperature and conditions on the effect of hot water treatment is under investigation and results are discussed. An account is given of experiments in which chemical disinfectants, formalin and others, were added to the hot water. Other articles deal with manuring of hyacinths, weed control in tulips, and narcissus pest control.

183. HASTINGS, R. J., AND BOSHER, J. E. 635.944 : 632.651.3  
**The nature of the bulb nematode (*Ditylenchus dipsaci*) populations in Supreme, Prince Albert and Imperator iris bulbs, and their control by thermal treatment.**  
*Canad. J. Res.*, 1938, **16** Sec. C., pp. 230-3, bibl. 3.  
 A 60-minute immersion of Dutch iris bulbs in hot water at 110° F. will destroy the nematode population which in these irises consists mainly of young larvae. Narcissi require a 3-hour immersion since the nematodes infesting them are in the more resistant pre-adult stage.

184. KRIJTHE, N. 581.145 : 635.944 + 635.935.722  
 De ontwikkeling der knoppen van enkele voorjaarsgewassen, I. Mignon dahlia and *Lilium regale*. (**Bud development in mignon dahlia and *Lilium regale*.**) [French summary 5 pp.]  
*Meded. LandbHoogesch. Wageningen*, 1938, deel **42**, verhandeling 3, pp. 53, being *Meded. Lab. PlPhysiol. Wageningen* **55**.  
 The course of bud development in the mignon dahlia and *Lilium regale* is traced and illustrated. It is considered that the data here presented should serve as a useful basis for determining optimum temperatures at which to store at different times.

185. BLAAUW, A. H. 635.944 : 631.432.2  
 De beteekenis van den grondwaterstand voor de bloembollencultuur. (**The importance of the water table level in bulb growing.**) [French summary 5 pp.]  
*Meded. Lab. PlPhysiol. Wageningen* **53**, 1938, pp. 91, bibl. 9, being *Verh. Akad. Wet. Amst. tweede sectie, Deel* **37**, No. 1.  
 An account is given of 3 years' trials, which are to be continued for confirmation of results at present achieved, on the effect of the water table level, and of growing in coarse and fine sand on bulb growth and production. Metal cylinders sunk in the soil were used and the effect of having the water level at 50, 60, 70, 80 and 90 cm. below the surface of the soil was tested. Particular varieties of Darwin and early tulips, hyacinths, irises and narcissi were used and the results of the different treatments on root, bulb and top formation are tabulated. The effect of different water levels varied with the medium. Thus in coarse sand the production of Innocence hyacinth was greater with a water level at 50 than at 60, whereas in fine sand the position was reversed. With a low water level a small number of roots are inclined to grow more strongly but this does not compensate for the disadvantage of a low water level. Brewig's opinion based on trials a few years ago is here confirmed that it is the higher levels of the soil, e.g. between 20, 30, 40 cm. below the surface, which are of the greatest importance for absorption of moisture by bulbs. An excessively low water level is not satisfactory and on the whole it may be said that production was better with a high than a low water level. Experiments are being continued.

## CITRUS AND SUB-TROPICALS.

186. SHULTIS, A. 634.3 : 338  
**Citrus enterprise-efficiency studies in southern California.**  
*Bull. Calif. agric. Exp. Sta.* 620, 1938, pp. 79.  
 The efficiency of citrus enterprise is determined by the following factors :—(1) yield per acre, (2) the price of fruit, and (3) costs per acre. In order to assist citrus growers in their management problems, the Agricultural Extension Service has studied these factors for southern California since 1926. Data presented here are limited to lemons and to navel and Valencia oranges.

187. THOMPSON, J. M. 634.31 : 338  
**The orange industry : an economic study.**  
*Bull. Calif. agric. Exp. Sta.* 622, 1938, pp. 85.  
 Statistical material is here presented and discussed. The following points in the orange industry are examined :—acreage, production, shipping, consumption, markets, prices, income and trade. Most of the data given refer only to the United States, which is the largest orange-producing country.

188. WELLMAN, H. R., AND STREET, M. D. 634.334 : 658.8  
**Maintenance of substantial equity in the pooling of lemons.**  
*Bull. Calif. agric. Exp. Sta.* 619, 1938, pp. 123.  
 In this bulletin the methods are examined and discussed by which a co-operative marketing association may handle the lemons produced by its members so as to spread the risks of marketing among the members and reduce costs.

189. WILLIAMS, R. O. 634.3  
**The citrus industry in Palestine.**  
*Emp. J. exp. Agric.*, 1938, 6 : 225-34, bibl. 7.  
 This is an account of the citrus industry in Palestine and its recent rapid development. Only notes of horticultural interest are abstracted here. The chief orange grown is the Jaffa, known locally as Shamouti, and the chief grapefruit is the Marsh seedless. A few tangerines and lemons are also grown. The watering is by irrigation and the salinity of the water is important ; 350 mg. chlorine per litre appears to be the limit for citrus. In small scale tests rough lemon rootstocks showed better resistance to salinity than sour orange or pomelo. The tendency among cultivators is to over-irrigate. It has been shown that a grove 3 years old will give high yields and remain in good condition with water applied at 44 day intervals during the season, a total of 360 cu.m. per dunum ( $\frac{1}{4}$  acre) in 3 irrigations. The water is usually applied by the basin or furrow systems. Free draining soils predominate in the citrus groves ; retentive soils and low lying groves need drainage or the fruit therefrom is rendered highly susceptible to wastage diseases. The necessity for windbreaks and their favourable effects on yield, soundness and grade of fruit have been established by experiment. The chief rootstocks are sweet lime, on which 90% of Jaffas are budded, and sour orange for grapefruit and Valencias. On sour stock the Jaffa is later in coming into bearing, more subject to alternate bearing and to suffer from the hot winds than it is on sweet lime. Valencias and grapefruit are not so affected on sour stock. The sweet lime stock is more subject to gummosis than sour orange and if budded too early to xyloporosis. Various local agricultural institutions are conducting rootstock experiments. The Jaffa orange is liable to bud mutation with the result that orchards often contain too high a percentage of inferior trees. Close planting in Palestine is prevalent and leads to much inconvenience in carrying out orchard operations ; its advantages are a much heavier

yield for the first 15-20 years, a smaller and less coarse fruit and mutual protection against winds. Spacing trials are in progress. Tillage is regular and systematic. Planting is often too deep, resulting in losses from root and collar diseases. It is now usual to allow budded orange trees to branch at 60 cm. from the ground and grapefruit and lemon at 80 cm. Pruning of dead wood is more necessary in the closely planted groves than in those more widely spaced. Grove sanitation, i.e. the removal of fallen and/or damaged fruit is enforced by itinerant inspectors. Manuring follows no fixed plan among cultivators, but the Horticultural Stations have adopted a routine (which is described) and research on the subject is in progress. Pests and diseases are countered by routine treatment. The handling of the crop is still primitive compared with other countries in that most of it is only rarely done mechanically and the difficulties connected with the use of a standardized box throughout the industry have not yet been overcome. The control exercised through the Citrus Fruit Inspection Service has done much to raise the quality of the exports.

190. PASCUAL, A. 634.31

**Citrus fruit production and trade in Palestine.**

*Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1938, 29 : 462T-9T.*

The recent remarkable developments in the citrus industry in Palestine are traced. The chief orange grown is the Shamouti (or Jaffa) with a few Valencia Late to prolong the season. The Shamouti is very liable to bud mutation and to minimize the possibility of these mutations being propagated a close supervision is exercised by the Department of Agriculture on the 250 nurseries of the country, which contain more than a million plants. The fertilizer formulae most suitable for Palestine soils are different from those of the U.S.A., and ignorance of this fact was in the early days a frequent source of error. Farmyard manure is the best organic manure and among the chemicals nitrate is the most important both in the nutrition of the trees and as a factor in increase of yield. Following nitrate come phosphoric acid and potash. The methods of harvesting and marketing are discussed. Experiments made with fruit conveyed in ships equipped with refrigerating plant showed that chilled fruit arrived in England without loss compared to the 5-7% loss with unchilled fruit. Attempts made to establish by-products industries are hampered by the short peak season, only a matter of 6 weeks. At other times there is insufficient surplus to keep the factories at full pressure.

191. PASCUAL, A. 634.31

**Orange cultivation and production in Spain.**

*Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1938, 29 : 339T-51T.*

The history of orange growing in Spain, the varieties grown and local conditions are first discussed. Propagation has formed a special study at the station at Valencia (Estacion naranjera de Levante, Burjasot, Valencia.—Ed.). The author quotes methods successfully used in California to strike cuttings of sour orange but does not say if these methods are employed at the station mentioned. Many of the Seville orange trees are being worked over to more commercially valuable varieties. A system of patch budding is used for this, but no information is given as to the number of buds placed on each tree or whether on trunk or branches. Cultivation is carried out mainly by superficial digging, the plough having in the past caused much root damage which is often followed by disease. In order to keep the fruit on the trees as long as possible all cultivation including irrigation is suspended as far as possible from October till harvest is over. The cessation of cultivation is also said to assist in ripening and to improve the quality of the skin. Manuring needs care as excess may result in unmarketable fruit. The formulae found most successful in various districts are given. Twelve irrigations a year are given on sandy soil and six on clay, the distribution of water being in the hands of water companies. The first watering is regarded as the most important; on it is considered to depend the flowering of the plant and the reduction of fruit drop. A few notes on packing and on pests and diseases follow.

192. CHOPPIN DE JANVRY, J. 634.323  
 Le grapefruit : sa culture aux Etats-Unis et à la Trinité. (**Cultivation of grapefruit in U.S.A. and Trinidad.**)  
*Rev. Bot. appl.*, 1938, **18** : 259-69, 329-50, bibl. 30.  
 Although the article contains nothing new it assembles a good deal of information on the cultivation methods employed with the grapefruit in U.S.A. and Trinidad and should be useful for reference. Several pages are concerned with propagation and with rootstock effect.

193. TANAKA, T. 634.322  
**The Suhuikan, a remarkable tropical loose-skin orange from Canton and Singapore.** [Japanese, English summary.]  
*Nettai Engei*, 1937, **27** : 99-114, bibl. 12.  
 The orange described here is grown in Canton provinces and is said by the author to be the same as the Limau Hijau Manis mandarin orange of Singapore. A Latin diagnosis of the species is presented.

194. FROST, H. B. 575 : 634.3  
**The genetics and cytology of citrus.**  
 Reprinted from *Current Science*, March 1938, special number on "Genetics", pp. 24-7, bibl. 14.  
 This paper deals almost entirely with the genus *Citrus*, and only occasional references are made to the genera *Poncirus* (trifoliate orange) and *Fortunella* (kumquat). Notes are given on polyembryony, clonal senescence, cytology (normal chromosome number, polyploidy and sterility), and genetics. Under the latter heading the following aspects are considered: the limits of crossing, heterosis, variability and heterozygosis, individual genes and gene mutation, polyploids, chimeras and bud variation.

195. LAPIN, V. K. 634.3 : 576.312.35  
**Investigations on polyploidy in citrus.** [Russian, English summary 1 p.]  
*Trud. Inst. hum. Subtr., Sukhum*, 1937, **1** : 4 : 3-69, bibl. 92.  
 The U.S.S.R. Research Institute for Humid Subtropics has studied the possibilities offered by the incidence of polyploidy in breeding citrus for frost resistance. In this paper preliminary results of this work are given. Briefly, they may be summed up as follows:—1. The most effective way to obtain polyploid citrus forms appears to be a large-scale caryological examination of the seedlings. 2. The percentage of polyploids among the seedlings varies, being dependent on the taxonomic position of the plants and on the origin of the seedlings whether hybrid, apomictic or spontaneous. 3. The polyploidy of citrus seedlings may be  $2n = 27$ ,  $2n = 28$ ,  $2n = 36$  and  $2n = 54$ . 4. The presence of a form with 28 chromosomes shows that heteroploid forms of citrus are likely to exist. 5. *C. trifoliata* and *C. deliciosa* show only very small percentages of polyploid forms in their apomictic seedlings and this fact coupled with their marked uniformity in morphological characters makes for genetical uniformity of apomictic seedlings and hence value for rootstock production. 6. All instances in which triploids occur in the progeny of *C. Limonia* and Shiva-mikan are due to the formation of unreduced egg-cells of such plants. Hence in order to obtain triploid hybrids with double sets of chromosomes in these species it is necessary to use them as mother plants in hybridization work.

196. REED, H. S., AND MACDOUGAL, D. T. 634.31 : 581.143.26  
**Periodicity in the growth of the orange tree.**  
 Reprinted from *Growth*, 1937, **1** : 371-3, bibl. 6.  
 In 1935 records were taken at the Citrus Experiment Station, Riverside, California, of the radial growth of the cambium, and elongation of shoots and roots in orange trees, in order to establish relationships between these increments. The orange trees studied (4 in all) were propagated from selected buds of the Washington Navel variety on sweet orange rootstocks. From the experimental data the authors conclude that the cyclic growth of these orange trees gives

important evidence of correlations in activity of meristems of shoots, cambium and roots. They also found that in addition to various physical factors there were inherent physiological factors affecting the activity of meristematic cells and groups of cells.

197. MAURI, N. 634.3-1.541.11  
 Méthodes possibles de sélection du porte-greffe chez les agrumes. (Rootstock selection with citrus.)

*Rev. Hort. Afr. N.*, 1937, **41** : 253-8.\*

The problem of finding suitable rootstocks for citrus is usually prominent in Algiers. A method is suggested for the rapid multiplication of any selected stock from a grown parent tree. Root cuttings from the selected trees should be made in December-January. These will root (90-95%) in 6 weeks if placed in sandy soil in shaded frames and a temperature of 75-80° F. maintained. When the resultant shoots are sufficiently strong they can be crown-grafted on the common sour orange previously planted some distance from other citrus plantations (at least four kilometres). The seedling from the fruits produced on these trees will be comparatively true and will provide a continual supply of rootstocks. If a smaller quantity is required the first root cuttings can be grown for a year in pots and planted out in the spring of their second year, after which they can be easily multiplied by shoot cuttings, and will so provide ample material for a standard orchard of nearly true seed-producers.

198. WOOD, J. F., AND REED, H. M. 634.323-1.547.6  
 Maturity studies of Marsh Seedless grapefruit in the Lower Rio Grande Valley.

*Bull. Tex. agric. Exp. Sta.* **562**, 1938, pp. 39, bibl. 16.

During two consecutive seasons studies were made at the Texas Agricultural Experiment Station on the physical and chemical changes occurring in Texas Marsh Seedless grapefruit during the ripening season which might serve as signs of maturity. Further the effects of various cultural practices on the maturity of the fruit and the possibility of improving the existing maturity standards and tests were also studied. The results were summarized as follows:—"The percentage of rind was constant in the grapefruit during each of the two seasons investigated. The percentage of rag decreased and the percentage of juice increased as the seasons advanced. As the rag decreased, the juice increased. The total soluble solids, as degrees Brix, was approximately constant for all plats. Citric acid decreased, and the ratio of solids to acid increased as the season advanced. In a study of the seasonal changes in fruit from various locations, fruit from widely separated orchards on different soil types and under different soil management matured at approximately the same time. Other factors may possibly exert more influence on maturity of grapefruit than soil type, cultural practices, and increments of age from time of blossoming. The best measures of maturity of grapefruit thus far are (1) the content of total soluble solids as determined in degrees Brix, (2) the ratio of solids to acids, and (3) the volume of juice."

199. WEST, E. S., AND HOWARD, A. 634.3-1.874  
 Some effects of green manuring on citrus trees and on the soil.

*Bull. Coun. sci. indust. Res. Aust.* **120**, 1938, pp. 36, bibl. 41.

A thirteen year green manure experiment with citrus at Griffith, N.S. Wales, is here reported. The growth of a winter green crop, tick beans, increased growth and yield in Washington Navel and Valencia Late orange trees compared with clean cultivated trees. The growth of a summer green crop of cow peas at first caused a decrease but after 10 years an increase in growth and yield. Growth of lucerne offered too strong competition and resulted in decreased growth and yield. There was a definite seasonal cycle of soil nitrate concentration in the tick bean and the clean cultivated plots, the former having a higher annual mean nitrate content in the surface soil, the latter a higher content in the lower lying soils. Little decomposition took place if tick beans were ploughed in too early. The soil nitrate cycle was little affected by the presence

\* Also, *Bull. Soc. Agric. Algérie*, 1937, pp. 67-70 and a full summary by P. Tissot, *Rev. Bot. appl.*, 1938, **18** : 272-4.

or absence of citrus. Ploughing in tick beans resulted in a rapid formation of ammonia, which persisted in the surface mulch throughout the early summer. Green manuring depressed the water table during growth. The increase in the water-holding capacity of the soil after several years' green manuring was statistically significant but practically unimportant. Loss of soil structure, however, noticeable in the clean cultivated plots, was reduced or removed by green manuring. The following possible explanations of the beneficial effect of organic matter on growth are discussed:—1. the supply of essential nutrients in a readily assimilable form; 2. good effect on water-holding capacity and soil structure; 3. the supply of some minor element; 4. the supply of readily assimilable iron; 5. the increase in partial pressure of  $\text{CO}_2$  within or above the soil; 6. the formation of growth substances; 7. direction, nutrition or supply of growth substances through mycorrhizas; 8. influence on soil micro-organisms.

200. KIRTBAYA, YU.K. 634.3-1.55  
**Citrus fruit harvest mechanization.** [Russian, English summary 15 lines.]  
*Soviet Subtropics*, 1938, No. 10 (50), pp. 17-21.

In the present article the ways and means are described by which thorough application of up-to-date instruments, machinery, etc. and the highest productivity of labour may be achieved and the loss of fruit due to physical injury may be reduced to a minimum. Among other devices recommended for harvesting citrus are a special citrus clipper designed by Kokonov and Kirtbaya which automatically disinfects the fruits at the cut at the time of clipping. The use of this clipper not only results in a very great reduction of storage loss but also enables the fruit to be kept in store for a prolonged period, i.e. 6 to 7 months instead of 2 months.

201. TAYLOR, G. G., AND BURNS, M. M. 634.3-2.19  
**Mottle-leaf of citrus in New Zealand.**  
*N.Z. J. Sci. Tech.*, 1938, 20 : 115A-9A, bibl. 2.

Citrus trees in the mottle-leaf condition remained unaffected in the Auckland District of New Zealand 15 months after treatments with zinc sulphate, contrary to results obtained in U.S.A. Spray applications of manganese sulphate + hydrated lime resulted in a suppression of the mottle leaf and a general improvement in foliage colour. It is too early to determine whether there has been an increase in vigour. The work is continuing.

202. WEST, E. S. 634.3-2.19  
**Zinc-cured mottle leaf in citrus induced by excess phosphate.**  
*J. Coun. sci. industr. Res. Aust.*, 1938, 11 : 182-4, bibl. 2.

At the Commonwealth Research Station, Merbein, there is evidence to show that mottle leaf of citrus curable by zinc sulphate spraying is apparently induced by the phosphate ion on the superphosphate plots in the fertilizer field. Potash also slightly increases mottle leaf (foliocellosis) when phosphates are also present.

203. KATAR'YAN, T. G. 634.3-2.111  
**Frost resistance of citrus plants.** [Russian, English summary 21 lines.]  
*Soviet Subtropics*, 1938, No. 11 (51), pp. 47-9.

In 1936 large scale investigations into the hardiness of various citrus trees were started by the U.S.S.R. Research Institute for Humid Subtropics. In this article preliminary results are reported of trials made with 22 lemon, 14 orange, 6 grapefruit, 10 mandarin and 5 other hybrid varieties. The trees used were one or two years old. Little difference in hardiness could be seen under conditions initiating the plant hardening process. So far the following conclusions have been reached:—Differences in the degree of frost resistance are more marked when the plants are left in the open during the winter than if they are sheltered. The sheltered plants generally become less hardy. Tissues of the same age in plants of different ages appear to have the same degree of hardiness. The different degree of hardiness among plants of one variety is attributed to the varying age of woody tissue and fibres. Under laboratory conditions lower temperatures are required for killing the plants than in the open. This is explained by the additional influences

in the open of such factors as snow, wind, etc. The hardier varieties among the species tested are named.

204. MOROZ, E. S. 634.3-2.111  
**The method of determining frost-resistance of citrus.** [Russian, English summary 12 lines.]

*Soviet Subtropics*, 1938, No. 10 (50), pp. 24-7.

Experiments conducted by the U.S.S.R. Institute of Plant Industry showed that the best way of determining the degree of hardiness of citrus is by freezing the whole plant or one of its branches, cut immediately before freezing. Branches cut 2 to 4 days prior to freezing and left in the open air showed higher resistance, while such held in a humid atmosphere became less hardy than the branches frozen on the tree. Otherwise there was no difference in the degree of frost resistance between the branches cut immediately before freezing and those frozen on the tree directly. The least harm was done to the plants when the temperature fell (during artificial freezing) at an approximate rate of 1.5° C. per hour, and when it rose afterwards at a similar rate. Abrupt freezing and thawing as well as continued freezing were found to be especially injurious to plants. When freezing the whole plant with roots exposed, there is no need to protect the roots, unless a subsequent growth study is proposed. The growth of root-injured citrus is greatly impaired.

205. FEDIN, A. KH. 634.334-2.111  
**Frost resistance of lemon trees as dependant on soil humidity.** [Russian.]

*Soviet Subtropics*, 1938, No. 10 (50), pp. 28-9.

Experiments carried out in Ajaria show that not only excessive soil humidity but also lack of moisture in the soil during the autumn-winter period reduce the hardiness of lemon trees. The experiments are described in some detail, data being given in tabular form.

206. IVANIDIS, G. P. 634.322-1.543.  
**Winter planting of mandarin trees.** [Russian, English summary 13 lines.]

*Soviet Subtropics*, 1938, No. 11 (51), pp. 40-4.

Planting mandarin trees in winter is desirable on economic grounds under Abkhazian conditions and has been studied for some time. The experiments described here in some detail show that the practice is to be recommended. Low temperatures (down to -7° C. or 19.4° F.) were found to cause no serious injury to trees, only the leaves and unripe shoots being affected. The best soils for winter plantings are well-drained sandy loams, containing large amounts of humus and having a fair water-holding capacity. During the winter when the mandarin trees find themselves in a stage of relative dormancy their roots continue to grow, developing small fibrous roots. This root development starts before the commencement of the vegetative period. Winter rains are useful in helping the formation of firm soil balls around the roots. The winter planting is carried out in the ordinary way with the only exception that the plants are not watered or manured, manure being applied later in the spring. The winter planted mandarins start growth some 20 days earlier than the others.

207. ALEXANDROV, A. D. 631.544 : 634.334  
**Helio-hothouses and their application for subtropical crops.** [Russian, English summary pp. 2.]

*Trud. Inst. hum. Subtr., Sukhum*, 1937, 1 : 1 : 1-141, bibl. 17.

In this work the problem of the construction and the use of glasshouses in U.S.S.R. are considered. In the first chapter the scientific principles are laid down. The second chapter deals with the uses and the effects of solar radiation under different climatic conditions. Chapters 3 and 4 present the results of sun-heated glasshouse tests in the zone of the humid subtropics. It is claimed that the microclimate in a sun-heated glasshouse may be very adequately controlled, and all the defects eliminated that are connected with artificial heating, namely uneven distribution of temperatures, difficulties in regulating the thermo- and hygro-regime, the presence of

conditions which make the plants very sensitive to external influences, and the need for subsequent hardening off. Conclusions were reached on the behaviour of lemon trees and certain other subtropical plants and vegetables in such houses. In the concluding chapter the cultural practice and economic aspects of glasshouse lemon trees are discussed. The paper contains a number of constructional diagrams and other illustrations. References are with one exception to Russian work and the author notes the lack of foreign literature on the subject.

208. KLOTZ, L. J., AND BASINGER, A. J. 634.31-2.19  
**The influence of various types of rind injury on the incidence of water spot of navel oranges.**

Reprinted from *Bull. Dep. Agric. St. Calif.* 27, 1938, pp. 232-41, bibl. 7.

Water spot is a non-parasitic breakdown of the rind of citrus fruits and is mainly due to imbibition of water from without by the white portion of the rind. Invasion of the water-affected area by blue and green moulds or other fungi results in a rapid decay of the fruit, known as the water rot stage. In California this trouble is commercially important only on navel oranges which mature during the rainy season. Oranges with open navel convolutions and the accompanying growth cracks, oranges in an advanced stage of maturity and oranges with hereditarily weak rinds are particularly susceptible to water spot. Fresh wounds in the rind usually result in an increase of the incidence of water spot, while old, callused or healed rind scars do not affect it. Early picking, orchard heating, use of windbreaks and careful orchard practices to avoid fruit injury are important in decreasing loss from water spot. Preliminary laboratory trials indicate that a certain degree of control over water spot in navel oranges may be obtained by protective sprays with paraffin wax emulsion.

209. CYPRUS DEPARTMENT OF AGRICULTURE. 634.3-2.7

**Pests of citrus trees and fruit.**

*Leaflet. Dep. Agric. Cyprus* 24, 1938, pp. 3.

In this leaflet brief descriptions of red scale (*Chrysomphalus aurantii*, Mask), soft brown scale (*Lecanium hesperidum*, L.), mussel scale (*Lepidosaphes beckii*, Newm.) and citrus aphid (*Toxoptera aurantiae*, B.d.F.) are given. Control measures against these pests, consisting of HCN gas fumigation and spraying with oil emulsion, are discussed. Citrus aphid alone can be effectively controlled by nicotine sulphate sprays.

210. KIRTBAYA, YU.K. 634.3-2.95  
**Mechanization of the methods of pest control in citrus groves.** [Russian, English summary pp. 2.]

*Trud. Inst. hum. Subtr. Sukhum*, 1937, 1 : 3 : 69, bibl. 11.

Various types and makes of spraying apparatus have been tested by the U.S.S.R. Institute for humid subtropics. The chief results of this work are given in a good English summary.

211. PAIKIN, D. M. 634.3-2.942  
**Black cyanide fumigation of citrus trees under tent.** [Russian, English summary 19 lines.]

*Zashch. Rast. Vredit.*, 1936, No. 16, pp. 79-89, bibl. 5.

Citrus tent fumigation tests have been made for some time in U.S.S.R., in which crude Russian cyanide (black cyanide) was used. The results were very satisfactory and, it is stated, black cyanide will be shortly introduced to the Soviet subtropics for fumigation of citrus on a large scale. The article contains graphs and tables.

212. QUALE, H. J. 632.752 : 632.944  
**The development of resistance to hydrocyanic acid in certain scale insects.**

*Hilgardia*, 1938, 11 : 183-210, bibl. 18.

Resistance to any less dosage in hydrocyanic fumigation than will also injure citrus trees has been exhibited by three of the important citrus scales of California from certain localities, though

the same varieties from other localities remain susceptible. The author considers that resistance has been brought about by natural selection. The spread of this resistance from its original foci is traced for each scale. Fumigation dosages in California even in non-resistant areas is higher than in citrus countries younger than California, where the schedules have been revised several times and always upwards. The scales concerned are the red scale (*Aonidiella aurantii*), the black scale (*Saissetia oleae*) and the citricola scale (*Coccus pseudomagnolarium*).

213. LINDGREN, D. L. 632.752 : 632.944

**The stupefaction of red scale, *Aonidiella aurantii*, by hydrocyanic acid.**  
*Hilgardia*, 1938, 11 : 213-25, bibl. 9.

A greater percentage of resistant red scale survive a normally lethal charge of HCN if they have first been exposed to a sublethal dosage of gas immediately before the regular fumigation. After a 2-hour interval they appear to come out of their stupor and are then actually easier to kill. This condition continues for about 3 hours after which they begin to react normally to a uniform concentration of HCN, i.e. as though no stupefaction had occurred. Non-resistant red scale require an hour before the stupefying dose is effective (resistant scale react immediately) and remain stupefied even after 3 hours.

214. IVANOVA, N. A., AND NEMIRITSKY, B. G. 632.752 : 632.951

**The estimation of insecticides for quarantine disinfection of living plants against scale-insects by submersion in toxic solutions.** [Russian, English summary 16 lines.]

*Zashch. Rast. Vredit.*, 1937, No. 12, pp. 127-35, bibl. 8.

Toxicity tests were made at the Sukhum Introduction Nursery of various contact insecticides, chiefly of water solutions of nicotine and anabasine salts, of naphthalene acid and acids of dolphin fat, pure nicotine and anabasine bases and nicotine and anabasine sulphates. The results of these tests showed that no 100% kill of the pests could be obtained by any of the preparations used. The most toxic preparations for the most resistant pests proved to be dolphin alkaloid soaps.

215. HOSKINS, W. M., BOYCE, A. M., AND LAMIMAN, J. F.

546.23 : 632.654.2 : 634.3+634.8

**The use of selenium in sprays for the control of mites on citrus and grapes.**  
*Hilgardia*, 1938, 12 : 113-75, bibl. 95.

An effective control of mites on citrus and grapes was obtained in California without injury to the plants by a spray made by dissolving selenium in a solution of potassium ammonium sulphide in such proportions that the composition corresponds to the empirical formula  $(K\text{NH}_4\text{S})_5\text{Se}$ . In view of the known toxicity of selenium to mammalian life, the possibility of any injurious effects to the consumer arising out of the use of selenium-containing spray is very thoroughly discussed. Analyses of treated citrus fruit show that the residue which is mainly free selenium is present up to 2 parts per million in the rind, while in the soil after 5 years of spraying a maximum of 2 parts per million selenium occurred in the first 6 inches, penetration below this being very slow and absorption by the tree being almost negligible. In grapes the residue was somewhat greater and they are shown to absorb more selenium from the soil. Evidence is reviewed which shows that the absorption of 3 parts of selenium per million in the whole diet causes no injurious symptoms and it is concluded that the proper use of selenium produces no hazard to public health.

216. MARLOTH, R. H., AND STOFBERG, F. J. 634.31-2.7-2.9

**The effect of lead arsenate and copper carbonate sprays on the quality of oranges.**

*J. Pomol.*, 1939, 16 : 329-45, bibl. 15.

Serious pests in South African citrus groves are the false codling moth (*Argyroploce leucotreta* Meyer), the Mediterranean fruit fly (*Ceratitis capitata* Wied.), the Natal fruit fly (*Ceratitis*

(*Pterandrus*) *rosa* Keh.) and the American bollworm (*Heliothis armigera* Hubn. (*obsoleta* Fabr.)). The present paper reports data obtained over a 4-year period on the effect on quality of Washington Navel oranges as determined by total soluble solids and acid content of the juice of lead arsenate and copper carbonate sprays. The trees, worked on rough lemon, were 15 years old at the start of the experiment. Details are given of the layout, the sprays, their application and the taking of representative fruit samples. Results are summarized as follows:—"Lead arsenate, applied as a spot-spray, at the rate of 1 ounce of lead arsenate per large tree, was responsible for a slight increase in the soluble solids/acid ratio in the juice of the fruit; and when cover-sprays carrying 5 ounces of it per tree were applied, it caused a marked reduction in acid. A residual effect of lead arsenate on acid reduction was evident in the two crops following the application of both spot- and cover-sprays. The effect of lead arsenate on acid reduction was more marked on the crop of the year following the application of the spray than on the crop maturing at the time of application. No evidence was obtained of any effect of lead arsenate on the total soluble solids in the fruit juice. Copper carbonate, applied in 5 cover-sprays at the total rate of 5 ounces per large tree, showed no influence on either the total soluble solids or the acid content of the juice. A slight earliness in colouring of the fruit sprayed with this material was observed. Chemical analyses showed that the quantity of arsenic present in the fruit juice following cover-sprays with lead arsenate was negligible. No increase in the lead or copper content of the fruit juice above that normally found resulted from cover-sprays of lead arsenate and copper carbonate."

217. KING, C. J., BECKETT, R. E., AND PARKER, O. 63 : 581.084  
**Agricultural investigations at the United States Field Station, Sacaton, Ariz., 1931-35.**

*Circ. U.S. Dep. Agric.* **479**, 1938, pp. 64, bibl. 13, cents 10.

In this bulletin an account is given of the work done in the period 1931-5 at Sacaton, Arizona, where the Field Station is conducted by the co-operation of the Bureau of Plant Industry and the Bureau of Indian Affairs. Notable climatic conditions are as follows:—A long frost-free period of 263 days; winter temperature very rarely goes below 20° F.; summer temperature may reach 117° F. with night minima over 80° F.; average rainfall 10 in. The following horticultural crops are under observation or investigation:—Citrus, dates, pecans, grapes, figs, pistache, and truck crops such as lettuce, muskmelons, carrots, peas, sweet potatoes, tomatoes, Bermuda onions and asparagus. *Dates*.—Results have been positive in proving that roots cut by ploughing or injured by rodents do not die but will produce normal growth from the cut ends. *Pecans*.—The Kincaid was the most consistently productive over the period 1931-5 under station conditions. *Grapes*.—The chief troubles are cotton root rot, fungus and root knot nematodes. *Pistache*.—Erratic behaviour in trials does not warrant commercial plantings. In addition a list is given of a number of ornamental plants and shrubs which have been tested and found satisfactory under Sacaton conditions.

218. WASSER, R. E. 632.752  
**Biology and ecology of the coecids on the Black Sea Coast.** [Russian, French summary 26 lines.]

*Zashch. Rast. Vredit.*, 1938, No. 16, pp. 41-9.

The scales considered in this article include *Aonidiella citrina* Coq., *Lepidosaphes beckii*, *L. gloveri*. All are parasitized by *Chalcididae*, but only *Prospaltella aurantii* is found to be of any economic importance, namely as a parasite of *Lepidosaphes gloveri*.

219. NIKOL'SKY, V. L. 635.976/7 : 632.7  
**Pyrausta nubilalis** Hb as a pest of woody plants. [Russian.]

*Zashch. Rast. Vredit.*, 1938, No. 16, pp. 122-3.

Various woody plants such as *Salix* species, tea shrubs, citrus, poplar and tung trees are attacked by *Pyrausta nubilalis* Hb. Recommendation is made never to interplant such trees with maize or in the neighbourhood of maize fields.

220. LAPIN, V. K. 633.85  
**Caryological studies of some *Aleurites* species.** [Russian, English summary 7 lines.]  
*Trud. Inst. hum. Subtr. Sukhum*, 1937, **1** : 4 : 69-75, bibl. 8.  
 A caryological description is given of four *Aleurites* species, namely *A. Fordii* Hemsl., *A. cordata* R. Br., *A. montana* Wilson, and *A. moluccana* Wild.

221. ANON. 633.85  
**State of tung oil plantations.**  
*N.Z. J. Agric.*, 1938, **57** : 473 and 475.  
 An analysis of the position of the tung oil plantations in North Auckland, New Zealand, show 55 acres of apparently satisfactory trees, 733 acres of unsatisfactory trees, 3,760 acres of dead or dying trees. The species is not stated but is presumably *Aleurites Fordii*.

222. KLIMENKO, K. T. 633.85  
**The first fruiting season of tung tree hybrids at the Batum Botanical Garden.**  
 [Russian.]  
*Soviet Subtropics*, 1938, No. 10 (50), pp. 35-6.  
 Some 183 hybrids were obtained at the Batum Botanical Garden from the cross *A. Fordii* × *A. cordata* and the reverse cross and were planted out in 1937. Observations made in 1938 showed that their growth periodicity differed from that of their parents. Both hybrid groups opened their buds later than *A. Fordii* but earlier than *A. cordata* trees. Descriptions are given of the character of the inflorescences. The work is continuing and data on yield and oil quality should be forthcoming in two or three years' time.

223. VAN DE KOPPEL, C. 633.85  
 Welke resultaten bereikte men tot nog toe met aanplant van Chineesche houtolie buiten China. (Present position of tung oil planting.)  
*Bergcultures*, 1938, **12** : 126-8.  
 In view of the diminished supply of tung oil available from China owing to the Sino-Japanese war other possible sources of supply are examined. A brief note is given of the degree of success attained in the cultivation of tung oil in each country in which would-be commercial plantations have been started. Particular attention is paid to the British Possessions, in most of which attempts have been made to establish plantations. The fact that success has not been remarkable is attributed in many cases to the use of *Aleurites Fordii* instead of *A. montana*. It is said that if at the outset (1929) these two varieties had been given preliminary trials side by side the greater suitability of *A. montana* for many localities would have been obvious and a considerable area of bearing trees would now be in existence. America has about 60,000 acres but damage caused by spring frosts is always liable to reduce the potential yield.

224. REUTHER, W., AND DICKEY, R. D. 633.85-2.19  
**A preliminary report on trenching of tung trees.\***  
*Bull. Fla agric. Exp. Sta.* **318**, 1937, pp. 21, bibl. 14.  
 Frenching of tung trees appears not to be confined to any particular soil series or narrow range of soil reaction, but to be correlated with the exchangeable manganese content of the soil. It is thought that control may be possible by means of manganese sulphate.

225. NOURI, O. 634.462  
**The cultivation of the carob tree in Cyprus.**  
*Cyprus agric. J.*, 1937, **32** : 109-16, bibl. 6.  
 The climatic conditions required by the carob, *Ceratonia Silqua*, are hot and humid summers and mild winters with reasonably low rainfall (i.e. 12 inches during November to February). Prolonged frost and snow do great damage as does a succession of very dry winters. The soils

\* See also *H.A.*, 8 : 824.

preferred are the deep loams of limestone formations, heavy clays or clay subsoils being unsatisfactory. Propagation is by seed, the plants being often subsequently budded, and these plants must be raised in pots or seed sown *in situ*, for owing to the strong deeply penetrating taproot devoid of laterals transplanting from nursery beds is seldom successful. At 4-5 years, when the stem diameter is 1½ in., the plants can be budded. This results in a strong erect shoot without laterals. This shoot should be headed back in its second year to 10 inches above the union. The 2 or 3 laterals which will result will form the framework of the tree. A budded carob fruits 3 years after budding. After-care consists of 2 winter ploughings to facilitate the penetration of water where the situation permits. It is important to remove cleanly all broken branches. The branches break easily in high winds, and if not attended to rot will spread into the heart of the tree. Apart from the weakness so caused, the hollows become hiding places for rats which constitute a major pest of the carob. An old carob may be regenerated from new shoots produced from the base of the trunk which has been cut level with the ground. Five or six basal shoots are budded and brought into bearing, the group being regarded as a single tree. There are no distinct varieties except the wild one which is useless and the commercial variety which in spite of various names seems, apart from the influence of environment, to be fairly uniform. Various uses to which the carob can be put are described.

226. KING, J. R. 634.63 : 581.47

**Morphological development of the fruit of the olive.**

*Hilgardia*, 1938, 11 : 437-58, bibl. 19.

The investigations described were conducted on the Mission variety of the olive (*Olea europaea*) in California and were concerned with the development of the flower, the general vascular relations in the flower, the development of the megasporophyte and the general morphological changes involved in the development of the fruit.

**TROPICAL CROPS.**

227. CHEVALIER, A. 589.492 : 63

Les labiées cultivées ou utilisées dans les pays tropicaux. (**Labiates cultivated in the tropics.**)

*Rev. Bot. appl.*, 1938, 18 : 470-88.

Some of the *Labiatae* which can be successfully cultivated in the tropics for the value of their products are described. Among these figure the genera *Mentha*, *Ocimum*, *Pogostemon* (patchouli), *Origanum*, those whose seeds produce a quick drying oil (*Perilla* and others) and those which produce edible tubers (*Coleus* spp.).

228. PARHAM, W. L. 631.874

**The wild tamarind (*Leucaena glauca* Benth.)**

*Agric. J., Fiji*, 1938, 9 : 1 : 18, bibl. 2.

*Leucaena glauca*, a small tree much used in the tropics for the combination of light shade and green manure which it provides, is considered by the author to be a subject which promises in the dry zone of Fiji, with the minimum of human intervention, to solve the allied problems of the prevention of soil erosion and the maintenance of soil fertility.

229. WOOD, R. C. 631.874 + 631.875

**Experiments on compost making.**

*Emp. J. exp. Agric.*, 1938, 6 : 350-68, bibl. 10.

The results of a number of experiments conducted by students of the Imperial College of Tropical Agriculture on compost-making are summarized. A note is added on the practical results of these experiments. The conclusions reached are as follows:—(1) It is not possible, even with standard material, to lay down a definite programme for composting. (2) The time available

for decomposition affects the methods adopted, as the more rapidly decomposition is wanted to occur, the more expensive will the process become. (3) Of the factors controlling decomposition, aeration and moisture are the most important. (4) Correction for acidity has not been found necessary in the conditions obtaining. (5) The use of inoculating material has not been found necessary unless very rapid decomposition is desired. (6) Farm stock is most economically utilized for the decomposition of farm waste since the best treatment any compost material can have before it goes into the compost heap is under the feet of farm stock, where it gets bruised and inoculated. [Author's summary (except paragraph 6).]

230. SPRENGER, A. M. 631.532/535  
 Het ongeslachtelijk vermenigvuldigen van houtige gewassen. (Vegetative propagation of woody plants.)  
*Bergcultures*, 1938, 12 : 798-805.

Dr. Sprenger discusses in general terms the methods of vegetative propagation particularly those used at the Wageningen research station in relation to woody plants. There is a short historical survey of the steps by which the present methods have been reached.

231. HUITEMA, W. K. 615.778/9 : 632.951.1  
 Selectie en landbouwkundig onderzoek bij *Derris*. (Selection and cultivation of derris.)  
*Bergcultures*, 1938, 12 : 1035-41.

The position of the derris industry in various countries is reviewed and some remarks are made on cultivation and storage. The following questions, it is said, still remain to be answered. (1) What is the most profitable form to plant? (2) What is the economic life of a plantation? (3) Is there any seasonal influence on rotenone content? (4) What is the most economical planting method: should the plants climb on laths, on support trees or be left prostrate? (5) What is the influence of manuring on rotenone ether extract content and on root production? (6) Has pruning a favourable or adverse effect on the rotenone content? (7) After digging up a plantation can the old stools be used again for replanting or should they be discarded? (8) What is the effect of the season of planting on the growth? (9) Under what crops can derris be used as a catch crop?

232. TOXOPEUS, H. J. 615.778/9 : 632.951.1  
 Over de mogelijke beteekenis van in het wild voorkomende *Derris* voor de veredeling van dit gewas. (On the possible significance of wild derris in the improvement of the cultivated races.)  
*Bergcultures*, 1938, 12 : 1042-3.

A study should be made of the wild forms of derris especially those selected by native fishermen in Java which usually have specially poisonous qualities (for fishing). This is the only direction in which the natives have exercised selection but among them forms might be found of use in improving the cultivated races. Much of the article is taken up with a description of improvements effected in wheat in various directions through the intervention of wild varieties, the suggestion being that the same could be done for derris.

233. KOOHAAS, D. R. 581.144.2 : 615.778/9 : 632.951.1  
 Eigenschappen van wortels van verschillende *Derris*-soorten. (Characters of roots of various derris varieties.)  
*Bergcultures*, 1938, 12 : 1045-53.

This is a discussion on the characters and treatment and packing of derris roots. It contains little information that has not already appeared at various times in *Horticultural Abstracts*. Some of the less familiar data are given below. Roots of toeba woeloeng L.C.B. 4-01, which is a selected derris variety, of 1 mm. thickness averaged 6.1% rotenone and 16% ether extract, roots of 1-2 mm. averaged 9% rotenone and 22% ether extract, while from roots of 4-7 mm. in thickness, the rotenone content (r.c.) varies from 6.5 to 5.5%, and the

ether extract (e.ex.) from 19 to 16%; the content gradually falls in the thicker roots, thus in thicknesses of 10-17 mm. the r.c. is less than 4% and the e.ex.  $\pm$  14%. These differences also occurred in another selected variety, toeba poetih, clone I Cultuurtuin. Thus when estimating the probable r.c. of samples a 5% difference may be safely allowed between thickest and thinnest. The r.c. is also affected by temperature. A sample of derris powder with r.c. 10.6% and e.ex. 25.1%, after an hour at 80° C., emerged with its r.c. reduced by 50% and its e.ex. by 40%. Therefore drying must be done at as low a temperature as possible and drying at 120° F. as recommended in literature on the subject seems to be uncomfortably near the border line. Considerable heat, too, can be generated in grinding the roots and the mills should be air-cooled. In air-drying the roots there is a very great saving in time if they are reduced to chips before drying rather than afterwards. There are no significant differences in r.c. and e.ex. attributable to differences between these processes. Roots can either be sun-dried or dried very effectively in a current of air at 45° C. Derris powder is very sensitive to atmospheric moisture. A dried sample (original moisture content about 5%) after standing in the shade, average temperature 27° C., relative humidity 95, acquired a moisture content of 24%.

234. JUNG, K. 632.951  
 Pflanzliche Insektizide. (Plant insecticides, pyrethrum, derris, *Mundulea*,  
*Lonchocarpus*, *Tephrosia*, etc.)

*Tropenpflanzer*, 1938, 41 : 431-43, bibl. 1 page.

This account is chiefly useful for the list of references to articles published in many different parts of the world on the different insecticides of plant origin.

235. CORBETT, G. H. 632.64 : 633.912  
 The giant snail (*Achatina fulica* Fer.)

*Malay. agric. J.*, 1938, 26 : 376-9.

Two containers for holding the slug and snail killing mixture meta and bran are described and illustrated. While easily accessible to these pests the mixture remains dry and poultry or animals cannot reach it. The first container can be made from an ordinary cigarette tin, the second, a mushroom type, is much larger and costs 30 cents. Both proved very effective.

236. JACK, H. W. 632.693.2  
 Destruction of rats.

*Agric. J., Fiji*, 1938, 9 : 2 : 2-4.

Methods of trapping, poisoning and hunting of rats, chiefly as practised in Malaya, are here discussed with a view to their application in Fiji. Purchasable traps which have been found effective and economical are Fuchs steel rat traps of the guillotine type, but the native-made traps of Malaya are also useful. The poisons recommended are sodium arsenite, barium carbonate, calcium cyanide dust injected into holes, and Squilltox, a proprietary poison reputed harmless to domestic animals. Hunting should be organized in work in the rice fields to be effective. The need for sustained efforts is stressed. Thick growths of cover crops provide harbourage and by their seeds food for rats. They are a considerable handicap.

237. ANON. 633.526.23  
 Exploitatie van vezelgrondstoffen in West Borneo. (Exploitation of fibre plants  
 in Dutch Borneo.)

*Bergcultures*, 1938, 12 : 1605-6, reprinted from *Econ. Weekblad*, Nov. 1938,  
 being *Meded. Dienst Boschwezen*.

*Terapbast*.—This fibre is obtained from *Artocarpus elastica* Reinw. though *A. communis* Forst. and *A. Teysmannii* Mg. also contribute. Its habitat is the secondary forest over the whole of West Borneo. It makes a very strong matting and binding material and was formerly used for clothing. It is exported as raw material for the manufacture of fibre articles (suit cases, driving belts, etc.). Present export is about 10 tons a year chiefly to Japan via Java. Only young trees with pliant bark can be used. The maximum diameter of such trees is 30 cm. The trees are

felled and cut into 2 metre lengths, the bark is scraped off and beaten with wooden hammers and the fibre thus loosened is peeled off. For local use the fibre goes through various processes such as washing in running water, more hammering, soaking, drying, according to intended use. For export it is simply dried and tied in bundles. The present price is from 7.50 florins per 100 kg. *Nilaoebast*.—Derived from *Diclidocarpus javanicus* O.K. (*Trichospermum javanicum* Bl.), a small tree found in secondary bush on abandoned dry rice lands. The local use of the stringy fibre is for bird and animal snares and for other purposes requiring considerable strength. The best fibre is obtained from branches about 2½ cm. thick. Very little is at present exported though attempts are being made to interest the Japanese. Prices are not known but the actual cost to the vendor f.o.b. is 7.50 florins per 100 kg. *Nipa palm leaves*. *Nipa fruticans* Thunb.—This palm inhabits estuary areas, often in large stands, the presence of brackish water being a necessity. In the Philippines the leaf stalk fibres are used in making coarse paper. It is not suitable for the finer kinds. It has no commercial use as a fibre in Borneo at present, though the fact that the Japanese are experiencing difficulty in obtaining a cheap fibre leads to a hope that the nipa may be favourably considered as a source of supply.

238. HACQUART, A. 633.526.23  
 Le sisal et ses fibres. (**Sisal and its fibres.**)  
*Bull. agric. Congo belge*, 1938, 29 : 507-33.

This report provides some account of the research in progress at the Sisal Research Station in Tanganyika at Amani, and at the Sisal Department of the Linen Industry Research Association, Belfast and elsewhere. The information provided (except that dealing with manufacture in Great Britain) has already been abstracted as published at various times in *Horticultural Abstracts*. The whole forms a useful summary.

239. GLOVER, J. 633.526.23 : 581.144.2  
 The root system of *Agave sisalana* in certain East African soils.  
*Emp. J. exp. Agric.*, 1939, 7 : 11-20, bibl. 13.

The results of root investigations of *Agave sisalana* in various soils are given. Excavation was carried out by the water method since this was the most suitable for use with only African assistants. A triangular prism with apex at the base of the plant and base about 18 in. wide at 10 or more feet away was excavated mainly by washing and it was found that such a section gave an accurate picture of the root system. The size of the root system of the average 5-year-old sisal plant was shown to be larger in the soils examined than might have been expected from the scanty literature consisting in the main of a few generalizations. The plants examined had many roots over 5 ft. in length, with a maximum radial spread of bearers (i.e. main suberized roots carrying feeders) to at least 10 ft. from the base. The main concentration is usually in the top 24 in. but roots have been found at 6 ft. down, the water-retaining properties of the soil largely influencing the depth of distribution. There is thus considerable root competition, especially in dry soils, under the spacing used in East African planting (8×3½ ft.) which is intensified when weeds are allowed to grow. Surface clean weeding only is advocated since deep cultivation injures the sisal roots. Roots grow well on soils with a pH 9.15 to at least pH 4.75. A high concentration of alkali is shown to upset the plant nutrient balance. A badly drained soil is fatal and in certain soils the presence of a water table has caused the death of roots even when a height of 12-18 in. above it.

240. HACQUART, A. 633.526.23  
 L'utilisation des déchets de sisal. (**Utilization of sisal waste.**)  
*Bull. agric. Congo belge*, 1938, 29 : 703-20.

Some methods of profitable utilization of waste from sisal factories are considered. *Recovery of short fibres*.—For reasons described in the paper numerous short fibres pass into the waste, amounting to 15-25% of the total fibre extracted. These fibres have a present value of about £13 10s. per ton. Up-to-date factories have plants installed for recovery. The process used in Java which produces a bright, white, exceptionally pliant and pure fibre selling at £1 per ton

more than the East African product is at present secret. *Combustion*.—The residue after recovery can be made into briquettes for fuel. The method is not considered economical. It can also be burnt and the ashes added to composts. This, however, leads to the destruction of the nitrates and organic matter in the refuse. *Compost*.—The ideal method is to compost all the material. The author stresses the great improvement in certain sisal plantations which has resulted from the use of this compost and gives some statistics, with the plaint that the profane always ask for figures. The method of composting in an East African factory (Taveta) which has taken it up seriously is briefly noted (a modification of the Indore method) and the opinion offered that the practice will shortly become general. *Alcohol*.—The method employed at Samé, Soudan, is selected for description. The alcohol produced is not suitable for carburation but does very well for the manufacture of perfumes, especially in French West Africa where its low price has proved attractive. The yield is 250 litres of 97° alcohol per ton of manufactured fibre. With an improved plant this could be raised to 350 litres per ton.

241. VAN DER MERWE, C. P. 633.61-2.7  
**Insects attacking sugar-cane.**  
*Sci. Bull. Dep. Agric. S. Afr.* **171** (Plant Industry Series 26), 1937, pp. 8, bibl. 7.

This bulletin contains information on sugar-cane insects in Natal belonging to the following genera: *Homoptera*, *Orihoptera*, *Isopelta*, *Coleoptera* and *Lepidoptera*. The damage caused by the various species is described and control measures against some of them are noted.

242. HINCHY, V. M. 633.65 : 581.11  
**The relation between frond transpiration and yield of sap in the nipa palm.  
*(Nipa fruticans)*.**  
*Malay. agric. J.*, 1938, **26** : 420-5.

On the plantation of the Nipa Distilleries Ltd., Malaya, a considerable daily variation up to 30% was found in the sap flow of the fruit spathes of the nipa palm (*Nipa fruticans*) when tapped, which could not be accounted for by variation in rainfall. (On this plantation the spathe is tapped once daily for a fortnight.) An investigation resulted in tracing this fluctuation to the influence of atmospheric humidity. Evaporation from the fronds was directly related to the relative humidity of the atmosphere, high humidity causing low evaporation and *vice versa*. It is considered that with the nipa palm so sensitive in its output to these atmospheric variations plantations should be shielded from hot sunshine and high winds and that high yields would be maintained and the average production made more profitable if attention were paid to these details. Interplanting with coconuts is suggested as the best solution.

243. FRANCOIS, E. 633.682  
**Le manioc. Sa production et son utilisation. (Production and use of cassava.)**  
*Rev. Bot. appl.*, 1938, **18** : 533-73, 682-707.

*Food value*.—The alimentary value of cassava (*Manihot utilissima*) for man and beast is discussed very thoroughly. *Toxicity*.—As regards toxicity the author, who is Inspector-General of Agriculture for the French Colonies, states that during a lifetime in the tropics including 15 years in Madagascar he has never come across a case of cassava poisoning although he has seen both natives and dogs eat the raw roots. He says further that cassava prepared in any other way than by boiling retains sufficient hydrocyanic acid to poison the eater and that the stomach processes are the perfect mechanism to insure that the last particle of acid is liberated. The fact that the poisoning does not usually occur is due to the action of the acid in the stomach being inactivated by some moderating factor the nature of which is still undetermined. The very few occasions when poisoning does occur are attributed to a failure or delay in the intervention of this neutralizing action. *Botany*.—Nothing justifies the botanical division of cassava into more than one species and the existence of clearly defined bitter and sweet or poisonous and non-poisonous varieties is a myth. It is a matter of environment. This assertion is based on botanical systematics and chromosome studies which are described briefly. A number of prominent

varieties in Madagascar are described from the botanical, horticultural and analytical stand-points. *Rotation*.—In growing cassava a crop rotation must be arranged. A cover crop, or fodder and litter crops are preferable because they can be used at home and will not distract the energies of the grower from his cassava. *Manuring*.—30 tons of farmyard manure every 5 years is preferable to 10 tons of wet straw applied annually. The rotation suggested is to plant cassava on manured land, following in turn by green manure, cassava, maize with a cover crop in conjunction, then to manure again and plant cassava. Experiments described with chemical manures have proved extremely contradictory and no advice is offered. *Tillage*.—Good tillage is essential for good tuber production. Various methods of obtaining this on different soils are noted. *Propagation*.—Reproduction by cuttings taken when the crop is lifted is the usual practice. The taking of cuttings at any other time has been shown by experiment to reduce the growth and the starch content of the roots of the plants supplying them. If the season does not permit the immediate setting of the cuttings they can be cut and made into bundles of 30 cm. diameter and stood upright with their bases plunged in dry soil. If the weather is wet the plunging can be omitted. Cuttings are planted obliquely, direct in the field, two-thirds of their length being below ground. Spacing has an important bearing on yield and should be separately determined for each variety and locality. In experiments in Madagascar recently a spacing of  $0.80 \times 1.60$  m. gave the best yields of those tried. It was also the widest. The most suitable time for planting the cuttings is another matter which can only be decided locally. *Cultural care*.—Weeds must be kept down especially in young plantings. Young plants can also be cut back to some extent to prevent wind damage. This practice is harmful to the yield of long-rooted kinds. Replacements of dead plants is inadvisable. It is expensive, the replacements never yield well, and if the plantation is more than two months old the surrounding plants will smother them. *Harvest and yield*.—There is an exact optimum time for harvest; earlier or later may lose up to 20% of the potential starch yield. The cycle is different in each country but the principle is the same. Growth must have ceased finally and the plant be in a resting condition. Experimental data are given. *Pests and diseases*.—Various pests and diseases attack cassava none of them seriously except possibly the cassava mosaic, of which the vector is the "white fly", *Bemisia manihotis*. A study of this virus provides many contradictory and at present unexplained phenomena. In one district in Madagascar mosaic is at its height during the rainy season whereas in another the arrival of the rains reduces the mottling and results in a flush of practically virus-free shoots. The mosaic is most active on poor soils but most damaging on well manured soils. In one district infected plants especially imported for study shortly afterwards lost all traces of mosaic while in another district with similar soil and climate 80% of all the cassava is infected. A grower planting out woody leafless cuttings had to suspend work for a week. On resumption he continued with cuttings from the same batch. As soon as growth started it was seen that all the first batch were full of mosaic while the second batch were practically free, the attack ending exactly on the last row of the early batch. A hurricane blew the leaves off a field of mosaic-attacked cassava. The subsequent growth was quite clean whereas the neighbouring plantations which had escaped the hurricane were still heavily attacked. *Manufacture and sale*.—The various products which can be obtained from cassava are described with notes on the methods used. The commercial aspect is discussed.

244. OPSOMER, J. E. 633.682-2.8  
 De invloed van de mozaïekziekte op de opbrengst van de cassave. (*Influence of mosaic disease on the yield of cassava.*) [Flemish-French summary.]  
*Bull. agric. Congo belge*, 1938, 29 : 317-22.  
 Experiments carried out in 1936-7 showed that the reduction in yield in cassava (*Manihot utilissima*) raised from mosaic-infected cuttings amounted to 44.4%. This represents the maximum loss, but actually in the field it would be very much less since there would be a good proportion of healthy cuttings also planted. The loss if the cuttings were taken at random would be in the neighbourhood of 10% while if the cuttings were carefully selected from apparently disease-free plants the loss in yield should be negligible.

245. DEPARTMENT OF AGRICULTURE, S.S. AND F.M.S. 633.72  
**Tea at the agricultural station, Cameron Highlands.**  
*Malay. agric. J., 1938, 26 : 137-53, bibl. 5.*

This article on highland tea is complementary to the recent bulletin issued by the Malayan Department of Agriculture on the cultivation of lowland tea (*Gen. Ser. Dep. Agric. S.S. and F.M.S. No. 29, 1937, H.A., 8 : 556*). Duplication of descriptions of standard practices common to both regions has been avoided but differences in detail are noted. The altitude of the Agricultural Station, Tanah Rata, is 4,700 to 5,000 feet above sea level; it is well sheltered with a temperature ranging from 50° F. at night to maxima of about 70° F. by day. Seasonal variation is slight. Rainfall is well distributed throughout the year, the total average being 100 inches per annum, the dryest season being January to March and June to September. Relative humidity, important in manufacture, is fairly constant, the means being 93-95% saturation at 9 p.m. to 75-85% at 3 p.m. The soils are weathered and decomposed granite overlaid by several inches of peat and weathered quartz containing a little clay and a peat layer above. *Cover crops.*—The most successful are *Vigna oligosperma* (*Dolichos Hosei*) and *Indigofera endecaphylla*. The latter has the disadvantage of rank growth. *Shade.*—Shade is not necessary at this altitude. *Green manure.*—*Tephrosia Vogelii* has a definite value as a contour hedge and gives a heavy crop of prunings several times a year on good soil. *Windbreaks.*—*Grevillea robusta* has proved satisfactory in the few sites open to strong winds. *Plucking.*—The plucking cycle is made once in 9 days. There is less elongation of stem in the highlands with the result that leaf and bud form a higher proportion of the total plucking. Plucking begins 2 years from transplanting, i.e. 3 years from sowing the seed in the nursery. *Pruning.*—A 3½-year cycle seems to be the best for average plucking. The general practice at the Station has been to rim lung prune and to manure after pruning. It is now thought that this may not be the best practice and other methods are being tried, i.e. manuring all plots before pruning and none after, and resting the bushes before pruning on some plots but not on others. *Manuring.*—Various manurial experiments are in progress with so far somewhat conflicting results. What is certain, however, is that the increased yield from organic over inorganic fertilizers did not remotely approach the figure at which the high cost of organic would have been recovered. *Yields.*—The first yields are realized 2 years after transplanting and rise steadily to 900-1,000 lb. of made tea per acre per annum in the 8th or 9th year. *Vegetative propagation.*—There is no difficulty by the etiolation method but limitation of time and space have led to its discontinuance. The rest of the article is concerned with manufacture and economics.

246. DEUSS, J. J. B. 633.72  
*Possibilités pour la culture du thé dans la région du Kivu. (Possibilities of tea planting in the Kivu district.)*  
*Bull. agric. Congo belge, 1938, 29 : 636-50.*

The author, who was formerly director of the tea research station at Buitenzorg, Java, in the course of a report on the suitability for tea growing of the Kivu district of the Belgian Congo enumerates the conditions necessary for success with this crop. Former coffee lands are seldom suitable for tea without considerable manuring. However, if the coffee shows great vegetative vigour to the detriment of its fruiting, the soil and climate are probably suitable for tea. An ample supply of humus in the soil is essential. As regards site it must be within an easy lorry drive of rail or port and the road must be open the whole year. There must be a permanent establishment of 1.5 labourers per hectare including factory hands but excluding the pruning specialists; these last can be shared by a number of plantations. The minimum planted area to keep the factory in regular work is 300-500 hectares. Smaller factories working 50-100 hectares are possible but uneconomic for reasons which are discussed. Small growers often sell their tea pluckings to a factory on a larger estate. If this kind of co-operation is practised a definite and identical routine must be faithfully observed on all the holdings. None should be situated more than 20 km. by lorry road from the factory. Overhead cable transport allows a wider extension but locks up a great deal of capital. Other essential factors in co-operative

growing are an identical tea type. It is not going to be easy to procure suitable seed since all the best teas are grown in the English, Dutch and French dependencies from whence export is prohibited. Chinese, Japanese and Formosa easily obtainable varieties are inferior and the price obtained is too low. The technical advice of specialists should be accepted. The land must be cleared without burning and after clearing be mulched and/or cover cropped. In rich land seed may be sown *in situ*, otherwise nursery grown stumps 2-3 years old are preferable. The best permanent planting distance is 90 cm. in and 1.50 between the rows. Light shade is provided by leguminous trees (*Leuceana glauca* in Java). From these all branches less than 1.50 m. from the ground are removed. They are first planted 3m. apart each way, later thinned out alternately, and finally cut out altogether when the trunks are 15 cm. in diameter 1 m. above the ground. [The manner of replacing these shade trees is not mentioned.—ED.] At 2 years old nursery or field grown trees are cut back within 5-8 cm. of the ground. The slanting cut is dressed with wound paint and probably shaded with straw or a bunch of leaves from the cover crop. The next cut is made 2 years later at 25 cm. above the ground. The first plucking after pruning, known as tipping, is a delicate operation to be entrusted only to the experienced. It takes place 3-5 months after pruning. The interval of time between plucking, usually 7-9 days, should be determined to suit the bushes and strictly adhered to. The maximum delay permissible between plucking and arrival at the factory is 4 hours. Since the tea from tippings and the first plucking is inferior, pruning should be done in rotation between plantations or sections of a plantation so that small quantities of this inferior leaf can be incorporated with the normal throughout the year and an even quality may thus be preserved throughout. The factory conducts the sales, those in charge should be experienced men capable of directing the cultural operations of the growers who must, if uniformity is to be maintained, follow instructions without question.

247. TADEOSYAN, P.YA.

633.72-1.874

**Rye as a green crop manure for tea.** [Russian.]*Soviet Subtropics*, 1938, No. 10 (50), pp. 42-3.

As a result of an almost complete failure (probably due to the high soil acidity, pH 4.1-4.3) of winter-vetches which were sown together with rye as a green crop manure for tea, the value of rye alone as a green manure has been studied. Contrary to expectation the tea yields were somewhat increased, i.e. by 311 kg/ha in the first year and 204 kg/ha in the second year. From his experimental data the author concludes that rye or any other non-leguminous crop may increase tea yields, provided the soils contain sufficient nitrogen.

248. CHEVALIER, A.

633.73

**Essai d'un groupement systématique des cafiers sauvages de Madagascar et des Iles mazareignes.** (**Systematic classification of the wild coffees of Madagascar and its islands.**)*Rev. Bot. appl.*, 1938, 18 : 825-43.

Twenty-three species of *Coffea*, some of them new, from Madagascar and its islands are described. With one possible exception (*Coffea lancifolia*) none, so far as is known, has any caffeine in its seeds. Nevertheless they are an interesting study for their properties are little known. For instance *C. mauritanica* is considered at Réunion as a possible substitute for real coffee except that it would be too strong and would be intoxicating. *C. Humboltiana*, according to Humbolt, provides a coffee equal to mocha, yet neither of these varieties contain caffeine. Several other varieties are used by the natives of Madagascar to make a caffeineless coffee. The author wonders whether improved kinds of these varieties might be so used commercially. Their possible value as rootstocks or for breeding should be investigated. All these wild coffees should be collected and grown at some research institute where their potential values can be properly estimated.

249. SIBERT, E. 633.73  
 État actuel de la production caféière en Côte d'Ivoire. (Coffee growing on the  
 Ivory Coast.)  
*Rev. Bot. appl.*, 1939, 18 : 461-70.

On the Ivory Coast coffee growing is stimulated partly by government financial manipulation (preferences, subsidies), but largely by the success of the small holding cacao plantations imposed on the natives before the war. These plantations have enriched their owners and completely changed the social complex. The former communal and patriarchal system has been replaced by an individualistic race of peasant farmers. The government, which has also established nurseries and factories in the principal centres, exercises a mild supervision over the native plantations and runs small experiment stations. The coffee grown comes mostly from local varieties of which the dwarf growing forms giving a small round bean are known under the group name of Petit Indénié, and the large berried taller growing forms, also much mixed, as Gros Indénié. Petit Indénié varieties are botanically grouped with *C. canephora* var. *Quillou* and commercially classed as *robusta*. Gros Indénié are botanically *C. excelsa* varieties and in commerce are known according to size as small, medium and large Indénié or simply as Indénié. Most of the coffee is grown in forest clearings, which are on the whole fertile and characterized by numerous patches of extreme fertility. Cultivation by the native holders is sketchy in the extreme. The author makes some suggestions for its control. It should be insisted that only a variety suitable to the environment and commanding an economic price should be planted. Only the really fertile patches should be planted, the forest should cover the rest especially in bottoms where the ground is damp, for the transpiration of the trees in dry weather has a beneficial effect on the atmospheric humidity. Burning when clearing should be stopped. Trees should be cut down or, preferably, uprooted as the stump will have to be grubbed anyhow, and allowed to rot for 1-2 years, the coffee being meanwhile raised from seed in nurseries. It is as well to leave in place any existing leguminous trees; and, if shade is required, to plant at once what is necessary. Only the best developed plants should be chosen when planting out and lifting should be done with a ball of soil on the roots. A cover crop which must be dug in annually is necessary until the coffee by extension of growth kills it out. Suckers should be removed and heading back practised at as great a height as possible according to richness of soil and the variety grown. The object is to keep the bush in full vigour so that the lower branches cover the soil as much as possible. Soil fertility and probable plant vigour are also taken into consideration when deciding on the spacing to be adopted in new plantations. Manuring should be started as the plantation soil becomes depleted and vegetable débris should be regularly dug in in the absence of a cover crop. Native methods of depulping and drying are primitive, and the coffee does not fetch a high price. Coffee probably has a future if cultural practice improves, but the obtaining of labour has become as much a problem for the peasant proprietor as it used to be for the white colonists, for, the author says, the introduction of permanent crops of cacao and coffee have meant the complete cessation of manual labour among the resident native population who depend entirely for their labour on the seasonal migrations from outside.

250. S'JACOB, J. C. 633.73 : 581.144.2 : 663.61 : 581.084.1  
 Korte mededeeling over wortelconcurrentie bij koffie in watercultures. (Root  
 competition with coffee in watercultures.)  
*Bergcultures*, 1938, 12 : 1366-70, bibl. 5.

I. Coffee and coffee together with *Salvia occidentalis* were grown in water-cultures (modified Shives solution). The coffee which was alone made rapid and healthy growth with strong and long roots. That growing with the *Salvia*, on the other hand, had a weak root system and slimy root tips. The leaves were pale and chlorotic without green veins. The striking differences in root growth are well shown by means of photographs. The *Salvia* was unaffected. None of the symptoms resembled those of any known nutrient deficiency. II. That the injury was not due to deficiencies in nutrient solution was shown by the fact that a fresh batch of coffee but without the *Salvia* grew perfectly for a further period of two months in the same solution

without any addition from which the coffee and *Salvia* had just been removed. III. Coffee alone with *Salvia occidentalis*, with *Panicum ambiguum* and with *Centrosema pubescens* was grown. Coffee and coffee with *Salvia* presented the same contrast as before; coffee with *Panicum* was even more retarded than with *Salvia*, the injuries were similar but accentuated. Coffee with *Centrosema* was practically normal though slightly less developed as to root and leaf than coffee alone. IV. Further experiments showed that when the culture solution was oxygenated every two days the coffee in the coffee and *Salvia* combination was nearly as well developed as coffee alone, the untreated coffee and *Salvia* remaining as in previous experiments. V. Coffee was grown in Shives solution to which was added every 3 days (10 c.c. per 3 litres) a culture solution in which *Salvia* had been growing for 3 months. Since after 2 months the coffee was growing quite normally, toxic action by the poisonous excretion from the *Salvia* roots could apparently be ruled out. On the whole it seems probable that the injury was caused by competition for oxygen with the *Salvia* roots and this is supported by the now well known fact that in well aerated (e.g. sandy) soil *Salvia* does much less harm to coffee than in heavier clay and that in clay soils the damage is always greater in the wet season. Of course *Salvia* and coffee do grow successfully together but in these cases it will be found that the *Salvia* only remains 3 months before it is cut down for mulch and as a result many of the competing roots die off and the soil is also better aerated by the incorporation of this mulch in it. Thus, while not ruling out the possibility that under anaerobic conditions the *Salvia* roots excrete a poison, it is more probable that the injury to the coffee is caused by the root competition for oxygen.

251. SCHWEIZER, J., AND S'JACOB, J. C. 633.73-1.541.11  
Eerste resultaten van een tweetal onderstamproeven bij Robusta-enten op Kaliwining en Djember. (First results of two rootstock trials with robusta grafts [in Java].)

*Bergcultures*, 1938, 12 : 1526-32, bibl.

Stock/scion trials with seedling stocks of various types of coffee and with robusta scions selected from various popular clones showed several types of incompatibility with non-robusta stocks. In the case of robusta stock and scion combinations success was usual but here again clonal preferences for a particular seedling stock were evident. It was shown that Dewavrai, a vigorous eelworm-resistant type, was completely incompatible with robusta. Excelsa from trees especially recommended as stocks gave only a moderate performance, while arabica stocks were only slightly better. The robusta clonal scions exhibited preferences, two of the three doing best, however, on seedlings of their own clones. Similar results were obtained in another locality with different material, that is stocks of robusta origin proved most suitable for robusta clones. Forms of incompatibility shown by different combinations were yellow leaves and failure to grow, shedding of foliage in dry weather and die back of shoot tips, abnormal swelling at the union. Examination of 100 specimens of this last abnormality showed that the more pronounced the swelling the greater was the starch accumulation in the scion. It is typical that in such cases the scion stem quickly acquired a growth of moss and lichens while the stock stem retained its natural gloss. The fact that even in the unsatisfactory combinations odd plants would grow away vigorously is attributed to the fact that the seedling origin of the stocks must cause liability to variation in structure and that occasional compatibilities must, therefore, occur.

252. VAN DER VEEN, R. 633.73 : 581.144.2  
Kromme penwortels. (Bent taproots.)\*

*Bergcultures*, 1938, 12 : 256-60.

Planting robusta coffee in Java with bent or twisted instead of straight taproots is shown to have, contrary to the usual belief, no adverse effect whatever on growth or yield. As long as the top growth is robust and a good green colour it is pure waste to discard any seedlings when planting out just because its particular root system happens to be a small one. The plants to discard are those with small yellowish leaves.

\* A summary and long abstract of this article are given in French in *Bull. agric. Congo belge*, 1938, 29 : 348-50.

253. BONDAR, G. 633.74  
 Une nouvelle variété de cacaoyer : l'Almeida. (**A new cacao variety, Almeida.**)  
*Rev. Bot. appl.*, 1938, **18** : 37-9.  
 What is claimed to be a hitherto unknown mutation of Forastero cacao (*Theobroma leiocarpum* var. *Para*) with a completely white bean has been found in Bahia. The flowers are white without trace of violet ; the petal veins and stamens are greenish white. The possibility of hybridization with Criollo (*Th. Cacao*) is excluded since the tree was known locally before the introduction of that variety to the country. The plant has been propagated by Dr. Manoel Pereira de Almeida who has over 1,000 plants, many in bearing. The colour has remained stable. The Cacao Institute's experiment station at Agua Preta, Bahia, has also a number of these trees under observation.

254. OSTENDORF, F. W. 633.74 : 581.162.3 : 581.175.11  
 Spontane kruisbestuiving en selectie op zaadlobkleur bij cacao. (**Natural cross pollination and selection on cotyledon colour in cacao.**)  
*Bergcultures*, 1938, **12** : 552-8, bibl. 4.  
 The method and possibilities of selection of cacao plants by cotyledon colour are discussed with special reference to work already done by other investigators. The data show amongst other things that cross-fertilization as opposed to self-fertilization is a very important factor in cacao plantations of Java. The author does not agree with the generally accepted conclusion that cacao is mainly fertilized by insect-borne pollen. He considers the wind to be the dominant agency without, however, giving his reasons. There is at present no adequate proof of the suggestion that plants from cross-fertilized seed are more vigorous than plants from self-fertilized seed.

255. ANON. 633.85  
 Thee-boomolie. (**Tea-tree oil.**)  
*Bergcultures*, 1938, **12** : 1133.  
 The misleadingly named tea-tree is really *Melaleuca alternifolia* and has, naturally, no relationship with the plant (*Thea sinensis*) which produces the tea of commerce. In this article, largely taken from *Chemische Weekblad*, 1938, No. 20, the uses, mostly medicinal, of the oil from *Melaleuca alternifolia* are discussed. Apparently it has great disinfectant qualities, rivalling those of carbolic acid but without the latter's poisonous or irritant properties.

256. CHARLEY, N. G. 633.825  
 Preparation of turmeric for market. **A new polishing machine.**  
*Agric. Live-Stk India*, 1938, **8** : 695-6.  
 An improved method of polishing turmeric (*Curcuma longa*) has been evolved by the Madras Agricultural Department. It consists of a horizontally mounted barrel of expanded metal, 2 ft. long by 3 ft. in diameter provided with a handle at either end for rotation by two men. The capacity is about 70 lb. of boiled or dried turmeric, which is polished in 7 to 10 minutes, the normal working speed of the drum being 30 revolutions per minute. To keep the turmeric from falling through the mesh the expanded metal is covered outside with a tight wrapping of woven wire of a mesh just large enough to allow the débris to escape during the operation of the drum. The apparatus is illustrated.

257. DEPARTMENT OF AGRICULTURE, S.S. AND F.M.S. 633.841  
 The growth of pepper on living supports.  
*Malay. agric. J.*, 1938, **26** : 288-9.  
 It is suggested that instead of the expensive hardwood poles, up which pepper (*Piper nigrum*) is trained in Malaya, living supports should be used as in India and Ceylon. A tree fulfilling the requirements in Malaya (rapid growth, deep rooting, leguminous and able to stand heavy pruning) is *Gliricidia maculata*. This tree may be pollarded 3 or 4 times a year and will yield up to 15,000 lb. per annum of green material which can be mulched on the soil. It is readily

grown from cuttings 8-10 feet long. The initial yields, however, in the first two years of a combined manurial and support experiment were heavily in favour of the vines on the hardwood supports. [Further results will presumably be published.—Ed.]

258. DAVIDIS, G., AND ZAAAYER, J. W. 633.88

Koemis koetjing en temoe lawak. (*Orthosiphon stamineus* Benth and *Curcuma xanthorhiza* Roxb.)

*Bergcultures*, 1938, 12 : 87-98, bibl. 20, reprinted from *Econ. Weekblad*, 14 Jan. 1938.

The cultivation, improvement and marketing are discussed of two little-known medicinal plants of Java. These are *Orthosiphon stamineus* Benth. (*Labiateae*), Kidney tea, and *Curcuma xanthorhiza* Roxb. (*Zingiberaceæ*) which has no English name. An article by de Soyza in which the medicinal virtues of the first named are extolled appeared in *Trop. Agriculturist*, 1936, 37 : 210-4.

259. PIDDLESDEN, J. H. 633.912

**Notes on a visit to Indo-China.**

*J. Rubb. Res. Inst. Malaya*, 1938, 8 : 331-42.

Many of the large rubber estates and factories of Indo-China were visited. Particular attention was paid to estate factory equipment and operation. A comparison is drawn between the conditions in Indo-China and Malaya.

260. FERRAND, M. 633.912

Constatations et remarques faites au cours d'une visite des principales plantations d'hévéas au Congo belge. (**Notes on rubber planting in the Belgian Congo.**)

*Bull. agric. Congo belge*, 1938, 29 : 54-64.

On the whole most of the *Hevea* plantations in the Belgian Congo are on suitable soil, i.e. forest land. Savannah land grows poor trees with low yields. Plantations are pure or mixed, that is with an interplanting of coffee or cacao. Pure stands suffer from too wide spacing, rarely as many as 200 trees per hectare. A proper number should be 280 at 12 years old, arrived at by selective thinning from an original stand of 400-450. In many mixed plantations the *Hevea* has been severely lopped to reduce the shade to the undercrop. A heavy decline in yield of latex has been the result. An equable balance is difficult to maintain for excess shade will render the coffee completely barren and it will remain weakly, even should the shade be reduced. On the other hand sufficient light to the coffee often means an unsatisfactory yield of latex per hectare due to the elimination of too many *Hevea*. Tapping leaves much to be desired, too much bark is consumed and on some plantations trees are even tapped daily, a procedure having a number of disadvantages which are enumerated. Suggestions are made for improving the tapping and collecting methods commonly used. Yields are usually lower than, but given good conditions can equal, those of the East. There are some notes on the factory treatment of the latex. In spite of some local opinion to the contrary, budded *Hevea* succeeds well. Failures can almost always be traced to lack of knowledge or care on the part of the workers.

261. VAN DEN ABEEL. 633.912

Note sur la culture de l'hévéa aux Indes néerlandaises, en Malaisie et à Ceylan. (**Rubber growing in Dutch East Indies, Malaya and Ceylon.**)

*Bull. agric. Congo belge*, 1938, 29 : 179-224.

The methods employed in the cultivation of *Hevea* in the Dutch East Indies, Malaya and Ceylon are briefly described under the following headings:—Statistical: Plant material: Notes on clones: Modifications in cultural technique; this includes propagation by clonal seeds of which both or one parent are known, regeneration—otherwise replanting—cover crops, selective weeding and jungle planting: evolution of tapping methods in new plantations. Some differences between the three countries in cultural technique and in experiment results are noticed. The paper is really a very clear summary of the current problems of rubber cultivation and of the progress made in their solution.

262. WORMSER, M. G. 633.912  
 Réflexions sur la conduite des plantations d'hévéas en Indochine. (Management of rubber plantations in Indo-China.)  
*Rev. Bot. appl.*, 1938, 18 : 389-400.

After a preliminary groan over mounting expenses, State extortion and the international situation, the author proceeds to discuss details of estate management in Indo-China. *Labour.* The cost of supervision of a native labour, chiefly characterized by its complete irresponsibility, is, he complains, quite staggering, amounting to 46.85% of the amount paid to the coolies themselves. Contract labour gives better results than free labour but in either case under present conditions there is nothing to look forward to but a progressive decline in quality. *Cover.* On older plantations the shade has killed out the cover crops but allows adventitious *Hevea* seedlings to grow. These form a useful guard against erosion and can be cut out when they become too large. *Crotalaria anagyroides* is used in young plantations especially in replantings. It has an annoying tendency to contract *Corticium* disease and pass it on to the young rubber trees, but keeping it cut back before it can become lignified has many advantages. The forestry method here is combined with a complete clearance of 2 metres radius from each tree trunk and selective weeding over the rest of the ground. The method is far from cheap and its sole merit is that it does completely prevent erosion for a time. The growth of the tree kills the undergrowth out in five years and other anti-erosion methods have to be employed. Tapping, on a full spiral every fourth day, is the most productive and economical method. The question of the over-tapping which occurs, especially when prices are high, is discussed. Obviously, says the author, the work of collecting latex is more interesting with rubber at a dollar a kg. than at 30 cents, nevertheless excess tapping is always paid for by subsequent low yields and a long period of recovery and it has to be decided whether this is economic or not. Discussion on tapping methods will never cease so long as planters only regard the secondary characters such as circumference or bark thickness as indications of tappability. A tree is only at its best when the formation of latex vessels is complete and the time necessary for this varies from tree to tree. Too early tapping hinders full development. With clonal plantations, however, it should be possible by research, to establish for each group the optimum time for first tapping, the length of time tapping should continue and the period of rest necessary to bring the tree back to normal. *Manuring.* Long term manuring in 5 years has raised yields from 275 kg. per ha to 750 kg. on poor land, and temporary cessation of manuring was immediately reflected in the yield. On rich land, however, the effect was much less marked. Young plantations also require manure. In the formula for young plantations potash should be high but in old plantations high nitrogen is required. The potash helps on the lignification of the tissues of the young trees and reduces their susceptibility to disease. *Propagation.* Whether budding or clonal seedlings are preferred it is essential to plant annually, either as replantings or extensions, the clone or clonal family which has given the best authenticated result for the year. This should never be omitted. It distributes the risks and keeps the plantation in a constant state of progression. *Research.* The need for research is emphasized. It is deplorable that lack of money and personnel always seem to bring to an untimely conclusion the investigations of the local research stations. It is necessary, too, for Indo-China to take its part in the movement to establish the sale of rubber on the basis of its physical and chemical qualities.

263. DIJKMAN, M. J. 633.912 : 581.163  
 Voorloopige gegevens over het bewaren van Hevea-stuifmeel. (Preliminary data on the storage of hevea pollen.) [English summary.]  
*Arch. Rubbert.,* 1938, 22 : 239-55, bibl. 14.

Hevea pollen stored at a temperature of 6° C. above a 27%-35% sulphuric acid solution will retain its viability for at least 19 days. The germinating power of the pollen may be accurately determined in 1 hour by placing the pollen on a substrate composed of glucose 10.53%-12.11%, agar-agar 1.5%, pH 4.5, at a temperature of 35° C. Lower temperatures slow down germination considerably.

264. DAHLE, H. E. 633.912-1.521.5  
 Kiemproeven bij hevea-zaad. (Germination experiments with hevea seed.)  
*Bergcultures*, 1938, 12 : 1270.  
 Some clonal seed germinates slowly and irregularly. Germination was considerably hastened and the percentage of success raised by filing the seed coat with a hack saw (convenient because of its short and sharp teeth) near the hylum. The complete removal of the seed coat improved germination but to a less extent than the filing. All seeds were soaked overnight in water. A woman can file 150-200 seeds in an hour. The treatment is not worth while in seed which germinates quickly.

265. SCHWEIZER, J. 633.912-1.541.11/12  
 Over den wederzijdschen invloed van boven—en onderstam bij *Hevea brasiliensis*. (Mutual stock/scion effect in hevea.)  
*Bergcultures*, 1938, 12 : 773-8, bibl. 20.  
 The stock/scion relationships in *Hevea* are discussed in the light of various experiments in the past. The following points are brought out. The stock can influence the yield of the scion. Certain clonal scions do better on seedling rootstocks of certain other clones than they do on seedling stocks from their own clone. The highest yielding rootstock in a rootstock trial will not necessarily raise the yield of the scion budded on it to a similar high pitch. Experiments have shown that it is the intercommunication of many or few of the latex vessels at the point of union of stock and scion that mainly decides whether the yield is to be high or low. At leaf fall there is a considerable reduction in latex flow and in the rubber content while other changes in the latex also occur. These changes take place simultaneously in stock and scion but their intensity remains specific to each. The author considers that the scion by the shedding of its leaves dictates the point of time at which the changes in both will begin. Cases of a clear influence of the composition of the latex of the stock on that of the scion are scarce, but cases are cited where the higher osmotic pressure in a stock has been communicated to its scion. Any increase in yield provided by the stock is usually higher the farther its tapping panel is away from the union. At the union any increase is at its lowest, owing, it is suggested, to colloidal chemical reactions between the two latexes. Some combinations are more affected than others. A suitable stock can be very useful in favourably influencing latex flow at leaf fall. Since this flow is possibly connected with the water relations of the stock a satisfactory union of the water conducting vessels of stock and scion is important. At leaf fall certain enzyme reactions (blueing) take place in the latex. In a recent experiment this reaction extended into the rootstock in 67% of cases of scions on seedling rootstocks from the same clone, but only in 50% when the scions were on alien rootstocks. Incompatibility of stock and scion is also apparent when the differences in the starch content of stock and scion are very marked. In these cases latex flow is usually low. A poor communication between latex vessels of stock and scion is also a source of bark disease.

266. SCHMÖLE, J. F. 633.912-1.541.11  
*Hevea brasiliensis* en *Hevea Spruceana* hybride als onderstam voor oculaties.  
 (Hybrids of *Hevea Spruceana*  $\times$  *H. brasiliensis* as rootstocks for budding.)  
*Arch. Rubbercult.*, 1938, 22 : 178-81.  
 Trials were made in Java to test the suggestion that hybrid stocks from the cross *Hevea Spruceana*  $\times$  *H. brasiliensis* gave better results as rootstocks for clonal *Hevea brasiliensis* buds than did the commonly employed *Hevea brasiliensis* seedlings from natural pollinations. Three different clones were used as scions and the usual precautions were taken to obtain comparable rootstock material. The stocks were budded in 1931 when about 2 years old, the first tapping was in 1935. Yearly from 1935 to 1938 the girth of the budded *Spruceana* hybrids was significantly greater than that of those on *H. brasiliensis*. Though in the first tapping year the yield from the *brasiliensis* seedlings was the greater, the *Spruceana* hybrids gradually caught up and in 1937 all 3 clones exceeded in yield those on *brasiliensis*, significantly in the case of two clones only.

but aggregating 25% for the three. There is a significant bark thickness of 13% in favour of the *Spruceana* hybrids. These results indicate the advisability of further work and with different and better scion clones.

267. DE JONG, W. H.

633.912-1.541.24

Oculeeren van rubber op de kweekbedden tegenover oculeeren in het veld.

(Comparison between nursery budding and field budding of rubber.)

*Bergcultures*, 1938, 12 : 1408-9.

An attempt is made to discover whether regional preferences between nursery and field budding of rubber are due to conservatism or are based on sound practical considerations. Field budding is preferred in the Straits because dry periods often occur when planting out nursery budlings, with the result that many perish ; there is a long season when field budding is possible in the Straits, the rounds can usually be made three times, and the heading back if necessary can be deferred till late in the rainy season. In Malang, Java, nursery budding presents no great difficulty. Dry periods after transplanting are successfully dealt with by mulching and watering operations, impeded in the Straits by larger areas and more expensive labour. There is a much shorter period suitable for field budding in Malang, and this is the principal objection to it. Nursery budding is often more economical in regenerating plantations since the existing rubber trees need only be removed a few months before replanting and go on yielding to the last moment ; in field planting, i.e. with rootstocks sown at stake, one or two years are required, with, of course, increased maintenance costs. The buds should be inserted in the dry season so that they can be planted early in the rains. Postponing the budding till the rainy season in the expectation of planting out before it ends leaves insufficient time.

268. MURRAY, R. K. S.

633.912-1.541.5

The care of young budded trees.

*Quart. Circ. Ceylon Rubb. Res. Scheme*, 1938, 15 : 108-16.

Young budded rubber needs more nursing than seedlings. Attention to the points now to be mentioned will often mean the difference between success and failure. In plants budded *in situ* the stock must be cut back to within 3 or 4 inches of the union and all stock buds suppressed till the bud shoot has sprouted. The author remarks that he is continually coming across cases in which through lack of care the wrong bud has been allowed to grow out. *Transplanting*. When the budded stump is transplanted from nursery to field too close cutting back of the root system is harmful ; laterals should not be cut back closer than to within 6 inches of the tap root. The stump must be dug up with care and properly and firmly planted in a fairly large hole and not just thrust in like a stick. The use of too small stocks is a frequent source of loss. The minimum diameter at the base should be one inch. The stock should be ring-barked 6 inches above the bud patch 10 days before planting. At transplanting the stock should be beheaded with a sloping cut to within 3 inches of the bud and the cut end waxed. At Dartonfield (Rubber Research Scheme's estate) transplanted budlings are covered with a basket (cost 2-3 cents) over which cover crops can be draped. Large budded trees up to 3 years old may be transplanted with success. Such trees are grown at least 18 inches apart in the nursery. When the bark is fully brown 8 feet from the base the tree is headed back at this height in the middle of an internode and transplanted as soon as the buds begin to swell, i.e. in 3 or 4 days. Two or three well-spaced branches are allowed to grow out unless the tree dies back to the level of the subsequent tapping panel, in which case only one shoot is retained. During the second year girth increment will have returned to the normal 3 or 4 inches. *Stock snags*. With stocks up to 1½ inches diameter, i.e. normal size, the snag may be allowed to decay and fall. With large stocks the snag should be cut off when the bud shoot has formed 18 inches of brown wood, the cut to be a small fraction of an inch below the point of union so as to leave no projecting "shelf". Surfaces under 2 inches across require no disinfectant, larger surfaces should be painted at once with 5% Izal or 10% Brunolinum Plantarium and on the following day given a protective covering. A completely satisfactory and cheap protective covering is unknown, but Skene's pruning mixture is recommended provided it is kept off the cortex and, as is necessary with all heat-absorbing black

dressings, its surface is either whitened or shaded. Serious rotting often occurs at the snag when very large stocks are budded (over 4 years). This may be often avoided if the stock snag is kept alive until the scion is 18 months old. The stock is cut off at 4 feet and ring barked 6-12 inches above the union. One or two shoots are allowed to grow from the stock to keep it alive till the final cut is made. The importance of a steep slant on this final cut is stressed. *Lateral branches.* All side shoots should be pinched off up to 7 feet from the ground to keep branches well away from the tapping panel. Budded plants which have not branched satisfactorily after 18 months should be headed back to 8 feet. *Manuring.* A warning is given against the uneconomical and possibly harmful use of over-doses of fertilizer. This is often seen on replanted rubber clearings. Phosphoric acid plays a most important rôle in the nutrition of young trees. A fertilizer high in phosphoric acid, medium in nitrogen and low in potash is recommended and the cheaper inorganic fertilizers are just as effective as the expensive organic manures.

269. MURRAY, R. K. S. 633.912-1.536

**Transplanting dormant budded stumps.**

*Quart. Circ. Ceylon Rubb. Res. Scheme*, 1938, 15 : 9-10.

Success in the transplanting of dormant stumps of budded rubber is jeopardized by the practice of trimming off the lateral roots close to the tap root, by the use of too small a stump (less than  $1\frac{1}{4}$  inches diameter at the base) and by planting during dry weather. The reasons for this are discussed.

270. DE JONG, W. H. 633.912

Een uitdunningsproef bij *Hevea* in het ressort van het Proefstation te Malang.

**(Thinning *Hevea* in Java.)**

*Archief. Rubbercult.*, 1938, 22 : 13-21.

Results of thinning experiments carried out in Java in plantations grown from selected seed and now about 10 years old are as follows. The selective reduction in 1935 of 520 per ha. trees to 460 and 420 occasioned no loss in yield and probably a small increase. Stem thickness is possibly slightly more on the thinned plots. Bark renewal is no quicker in the 460 plot and slightly quicker in the 420 plot. Differences were perceptible a few months after thinning. To minimize the temporary loss it is recommended that all the thinning should not be done at one time but should be carried out in 2 successive years, say 50 trees at a time. Thinning to 320 trees per ha. produced distinct reduction in yield. Increase in stem diameter was not better than that of the 420 plot. Bark renewal was more rapid than on the best of the two other plots but the economic significance of this is still in doubt.

271. DE JONG, W. H. 633.912 : 581.14

Een beschouwing over den diktegroei van den stam van *Hevea*. (Trunk girth increase of *Hevea*.)

*Bergcultures*, 1938, 12 : 151-65, bibl. 7.

Some factors influencing rapid increase of stem girth in *Hevea* are discussed. These may be correct choice of high yielding but quick growing clones; early planting of budded stumps though, under climatic conditions in Java, this is only possible if the seed for the rootstocks is sown early; manuring, which in many cases has advanced the tappable age of the tree by at least a year; clean weeding round the tree from 6 to 9 feet; mulching with cut plant material; and shallow hoeing round the trees in dry weather. From these and perhaps other methods it should be possible to evolve some system which would advance the tappable age of the tree by 1 to 2 years.

272. ANON. 633.912-1.874

**The effect of lalang on the growth of young rubber trees.**

*J. Rubb. Res. Inst. Malaya*, 1938, 8 : 227-31.

Experiments were carried out to discover the cause of the injurious effect of lalang grass (*Imperata arundinacea*) on the growth of young rubber. Marked reduction was noted in the growth of the

trees on the lalang plots, compared with those on the clean weeded plots and on plots carrying a leguminous creeping cover crop (*Centrosema pubescens*). The cause of the reduction could not be ascertained though probably root competition is a major factor involved.

273. VAN BAALEN, J., AND HEUBEL, G. A. 633.912-1.874  
 De meest doelmatige grondbedekking in volwassen rubbertuinen. (**The most suitable ground cover in fully-grown rubber plantations.**)

*Bergcultures*, 1938, 12 : 585-98, bibl. 60.

The suggestion discussed is that ground cover under *Hevea* should be provided by a rotation of leguminous cover crops and natural undergrowth. Soil which becomes legume-sick can be restored by allowing the wild cover to grow up and after a few years any nitrogen deficiency which has developed can be eliminated by the removal of the undergrowth and replanting with a leguminous crop. Some kind of cover is now considered essential to prevent erosion and to provide humus.

274. AKHURST, C. G.\* 633.912-1.874  
 Further notes on burning, covers, and manuring.

*Quart. Circ. Ceylon Rubb. Res. Scheme*, 1938, 15 : 117-22.

In establishing plantations of long-term crops such as rubber on jungle land the practice of completely burning off all the jungle débris, still the most suitable method for annual or close growing crops, should give way to a light burning or scorch. Much of the organic material is thus conserved and its retention will prevent erosion and increase humus. Light burning reduces the chance of soil injury through burning (especially on peat can permanent harm be done), reduces the loss of the more volatile mineral plant foods and avoids the uneven distribution in the soil of the large amount of minerals in the ash of burned trees. Light burning destroys fewer seeds and enables natural cover to be quickly re-established. This cover should be used in combination with a leguminous cover. The ground cover, especially in dry districts, provides very heavy competition for moisture with the roots of young rubber. This can be greatly reduced by cutting the cover at regular intervals and using the débris as mulch. Disadvantages of light burning lie in the harbourage provided for rats and the difficulty of carrying out adequate root disease work where there is much lying timber. In Malaya there is little difference in cost between normal and light burning, but if clearing is done without any preliminary burning, the cost is nearly doubled.

275. VAN LEEUWEN, A. 633.912-1.8  
 Iets over het bemesten van rubber-heront-ginningen. (**Notes on the manuring of young rubber.**)

*Bergcultures*, 1938, 12 : 855-8.

The advantages of manuring young rubber are discussed, chief among them being the trees' earlier tappability compared with unmanured trees, at least a year being gained. Some data obtained from experiments described are (1) the manured wood had a much higher ash content than the unmanured ; (2) nitrogen content was much higher in manured than in unmanured young trees, but the nitrogen content of unmanured 30-year-old trees equalled that of manured young trees ; (3) potash was higher in the manured, sodium in the unmanured wood ; if the potash is deficient in the soil the plant apparently makes shift with sodium ; (4) calcium was higher in the manured trees but only slightly higher than in the unmanured 30-year-old trees ; (5) magnesium was the same in all ; (6) phosphorus was much higher in the manured trees compared with both the other groups. The trees will apparently always "eagerly" absorb this element whenever it is present.

\* Paper by C. G. Akhurst, Rubber Research Institute (Malaya) at 14 Annu. Conf. incorp. Soc. Planters, Kuala Lumpur, Penang, September 23-25, 1938.

276. MURRAY, R. K. S., AND DE SILVA, C. A. 633.912-1.8  
**Field experiments on Dartonfield Estate. VI. Manuring experiment with mature rubber.**

*Quart. Circ. Ceylon Rubb. Res. Scheme*, 1938, 15 : 1-8, bibl. 3.

The results for the first year of manuring experiments on the Dartonfield Estate of the Rubber Research Scheme, Ceylon, are given in terms of yield, girth increment and bark renewal. The control plots have given a barely significant lower yield than the manured plots. No effects were produced on girth increment or bark renewal but foliage colour was greatly improved. Mineral phosphate markedly stimulated the growth of *Pueraria* cover.

277. MURRAY, R. K. S. 633.912-1.556.8  
**Tapping of bud grafts.**

*Quart. Circ. Ceylon Rubb. Res. Scheme*, 1938, 15 : 10-13.

In budded *Hevea* the girth, bark thickness and number of latex vessels do not decrease with increasing height to the same extent as in seedlings. Budded trees may, therefore, be tapped higher without so great a loss in crop. Budded trees do not possess the heavy cork layer characteristic of the bark of the basal portion of seedling stems. The minimum girth for commercial tapping should be 20 inches at a height of 3 ft. from the union. Tapping on a half-spiral cut either on alternate days or once in 3 days is recommended. There are clonal differences in response to different tapping methods. The tapping cut should start at a height of 40 inches above the top of the union. Controlled experiments show no advantage in the Ceylon method of changing panels yearly or half-yearly instead of tapping right out as in other countries. The slope of the cut should be steeper on budded trees, the angle being 25-30°, because the thinner bark gives a narrower channel for latex flow and the latex may overflow on to the bark if cutting is too flat. The thin-barked budded trees require special latex cups which will not wound the bark. These are described.

278. GILYAROV, M. S. 633.913-2.6/7  
**Factors determining injuriousness of soil pests and their significance for the cultivation of rubber plants.** [Russian, English summary 33 lines.]

*Zashch. Rast. Vredit.*, 1937, No. 13, pp. 41-53, bibl. 33.

The injuriousness of a number of soil pests has been studied for some time at the Ustimovka experiment station (Ukraine) both in the laboratory and the field. The plants used in the experiments were *Taraxacum kok-saghyz* and *Scorzonera tau-saghyz*, rubber plants grown in Ukraine which display a particularly marked reaction to root damage due to soil pests throughout the growing period. The injurious activity of the various larvae was markedly stronger in moist soils rich in humus and decayed plant material than in dry and poor soils. The number of plants damaged by the pests was found to be greater in drought than in moist years, the number of pests being equal. After rainfall the number of plants damaged decreases. In drought years more serious damage was done by the soil pests to plants growing in high positions than to those in low positions. Damage done by the pests proved less on watered areas than on those left unwatered. The injurious effect of the pests depended on the moisture of the soil, and the more humus it contained the more saprophagous these pests proved to be. The disposition of various species to saprophagy is different. All species except two studied at Ustimovka were saprophagous. Soil pests in soils rich in humus and cultivated for a long time are mainly saprophagous. [From author's summary.]

279. S'JACOB, J. C., AND DE FLUITER, H. J. 633.912-2.4 : 581.144.2  
**Is er verband tusschen den toestand van de plant en er mate van virulentie van wortelschimmels. (The general condition of the tree and its relation to the virulence of root diseases.)**

*Bergcultures*, 1938, 12 : 1290-2.

*Case I.*—About 400 healthy rubber trees in Java in two plantations of 200 each were ringed near

the ground so that by their slow demise light might gradually be admitted to the coffee plantations below. The trees, however, were scarcely affected for 3 years when about half in each group started to die off. At the same time some of the coffee started to die as well. Exposure of the roots of all the ringed trees showed that in both plantations the dead and dying were attacked by *Fomes lignosus*, while of those in apparent health only 4 in all were attacked. The infection was also the cause of the injury to the coffee. Hitherto the plantations had always been free of root disease. *Case II.*—In a mixed plantation of *Hevea*, coffee and *Leucaena glauca* the two last were cut back to the ground. Shortly afterwards they all suffered injury from *Fomes lignosus*. In a normal state both coffee and *Leucaena* can carry this fungus without injury. *Case III.*—A young *Hevea* plantation was protected by windbreaks of tall *Leucaena glauca*. Root disease attacked the whole area. Although the tall *Leucaena* remained unaffected the origin of the disease was traced to some which had been cut back to the ground. *Case IV.*—When some *Leucaena glauca* trees were cut back to stumps all the young *Hevea* in their vicinity were attacked by *Fomes lignosus*. The trees adjoining uncut *Leucaena* were not attacked. From these cases and other evidence it is concluded that the disease organisms may exist in a saprophytic or dormant state until some adverse change in the physical condition of the host destroys the balance between them and turns the organism into a dangerous and active parasite injuring any roots with which it comes in contact, not only of the host but also of neighbouring trees.

280. SOESMAN, J. G. 633.912-2.4 : 581.144.2  
Wortelschimmels en Heveaherontginningen. (Root disease in replanted  
hevea areas.)

*Bergcultures*, 1938, 12 : 1239-44, bibl. in text.

A review of the methods used in Java and elsewhere to combat root disease (*Fomes lignosus*) of *Hevea*, a trouble which is specially dangerous in young replantings. The usual planter's idea is to examine the roots of suspected trees to a distance of 2 feet from the stem and to a depth of 2 feet. The author shows that this is not far enough in either direction and produces photographs showing trees attacked at a depth of 16 feet. Another method consists in clearing the ground to be planted of all surface timber and root remains to a depth of 3 feet, and letting the ground lie fallow for from 7 months to 2 years with the idea of starving out the fungus. Against this an authority is quoted to show that the chance of infection may be even greater in a cleared area than in an uncleared. The author suggests that in addition the sides of newly dug plant holes, also paths and cart-tracks, should be examined for traces of diseased weed. A third suggestion is to sow a green manure on the ground to be planted. There are two schools of thought here, (a) that a thick cover crop of immune species prevents the spread of disease, (b) that by planting woody varieties known to be susceptible the disease tends to keep to these crops and that by following up the root system of an infected bush the source of disease can be easily found and removed. *Centrosema* on the other hand appears to carry the disease underground without above ground indication. Resistance to *Fomes* attack appears to be an individual character. Mother trees able to impart their resistance to their descendants have not yet been discovered. It is probable that *Hevea* in poor condition is more susceptible than strong growing plants.

281. DE FLUITER, H. J. 633.912-2.4 : 581.144.2  
Wortelschimmel en heveaherontginningen. (Root disease in replanted rubber  
areas.)

*Bergcultures*, 1938, 12 : 1258-66, bibl. 17.

Root disease in young hevea plantations is discussed somewhat fully. Considerable use is made of the material provided by the paper which is the subject of the previous abstract (Soesman). The investigations in Malaya are noticed at some length.

282. CALVINO, M. 551.556.1 : 634.1/8  
**Progress of fruit cultivation in tropical and subtropical countries : its importance in countries of the temperate zone also.**  
*Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1938, 29 : 442T-52T, bibl. 18.*  
 The principal and also some less known fruits of the tropics and sub-tropics are noticed in turn. The information provided is very varied and consists in the main of items of information culled from the publications of various research institutions.

283. MILSUM, J. N. 634.47  
**Garcinia atroviridis—or Asam gelugor.**  
*Malay. agric. J., 1938, 26 : 181-5, bibl. 2.*  
 The unripe fruit of *Garcinia atroviridis*, sliced and dried, forms a sour relish extensively sold throughout Malaya for use in curries. A botanical description is given of the tree. As with other garciniias the tree is unisexual. From the fact that almost all the female flowers set fruit even though the male and female trees are often separated by considerable distances parthenocarpy is suspected. A mature tree will produce several hundred fruits the main season being from January to June. The unripe fruits when gathered are sliced singly by hand into pieces  $\frac{1}{2}$  in. thick or into thinner slices during wet weather to facilitate drying. The pieces are dried in the sun on trays of bamboo slats, the percentage of prepared product to fresh fruit, being approximately 17%. The local name of the prepared product is asam gelugor.

284. DJOU, Y. W. 634.571-2.78  
**Lychee fruits destroyed by Deudorix epijarbas Moore.**  
*Lingnan Sci. J., 1938, 17 : 401-5.*  
 A note is given of the infestation of litchee fruits on plants of *Litchi chinensis* growing in pots in Lingnan University grounds by the caterpillar of *Deudorix epijarbas*. This lepidopterous borer does considerable damage entering the fruits when they are quite small. As the larva grows it generally emerges from any small fruit it may happen to be in and enters a larger fruit. No control measures are suggested, but it is noted that a lacewing fly is sometimes parasitic on the pest.

285. BURRET, M. 634.6  
 Brasilianische Palmen als Nutzpflanzen. (**Palms of Brazil and their economic uses.**)  
*Tropenpflanzer, 1938, 41 : 477-502, bibl. 11.*  
 The writer gives a not very concise account of the very large number of palms which are either indigenous to Brazil or have now become firmly established there. He classifies them as chiefly producing oil, wax, fibre, fruit and vegetable ivory etc. Many of them of course come under several headings. The most important product of these palms on the world market is piassava, i.e. the fibre from two species, namely *Attalea funifera* and *Leopoldinia Piassaba*.

286. ALIBERT, H. 632.7 : 634.6  
**Étude sur les insectes parasites du palmier à huile au Dahomey. (Insects attacking the oil palm in Dahomey.)**  
*Rev. Bot. appl., 1938, 18 : 745-73, bibl. 15.*  
 Descriptions, life histories, injury done and methods of control of the insects attacking oil palms in Dahomey are noted.

287. DENNETT, J. H. 634.6-1.8  
**Manurial experiments on oil palms.**  
*Malay. agric. J., 1938, 26 : 273-81.*

This report contains further observations on experiments in the manuring of oil palms in Malaya of which the early stages have already been discussed.\* The results to date demonstrate the

\* *Malay agric. J., 1935, 23 : 321-5 and 1937, 25 : 286-96, H.A. 5 : 486 and 7 : 1044.*

value of manuring with rock phosphate at regular intervals (annually from the 7th year). The value of applying a more complete manure at longer intervals is not yet assessed, but as an insurance measure the application of a complete mixture including magnesium every third year from the 12th inclusive is advisable. While applications of nitrogen and phosphate have given increased returns from young palms, it is not certain yet whether this is economically profitable.

288. WEBSTER, C. C. 634.6 : 581.084

**A note on a uniformity trial with oil palms.**

*Trop. Agriculture, Trin.*, 1939, 16 : 15-9, bibl. 6.

The trial described here was undertaken with a view to obtaining information likely to be of guidance in designing field experiments with oil palms in Southern Nigeria. Results indicate that the useful range of plot size is from 16-32 palms. Plots of half an acre (holding about 32 palms) replicated 6 times might be expected to demonstrate as significant a difference of 20% in the case of a single season's yield, of 15% if the average of 2 seasons' yields were used, and of 10-12% if four seasons' yields were available and the yields for the experimental year were corrected by the method of Wishart and Saunders. [See *Principles and practice of field experimentation*. Empire Cotton Growing Corporation 1936.] If differences only as low as 20% are required 16 palm plots and 2 seasons' yields should suffice. The presence of biennial bearing palms may have to be taken into account.

289. DEPARTMENT OF AGRICULTURE, S.S. AND F.M.S. RESEARCH BRANCH.

634.61

**Dwarf coconuts in Malaya.**

*Malay. agric. J.*, 1938, 26 : 282-7, bibl. 4.

As a result of investigations aided by a questionnaire sent to all estates planting over 20 acres the following notes have been prepared on dwarf coconuts in Malaya. Under Malayan conditions dwarfs are unsuited to peat soil without irrigation and will not yield commercial crops on light or medium mineral soils. At the Coconut Experiment Station, Port Swettenham, a very heavy and particularly intractable soil also curtails the annual yield to 30-60 nuts per palm. The precise soil conditions governing success have not been so far worth ascertaining in view of the limited plantings. No serious complaints of the quality of the copra were entered. The yellow type, which requires more nuts to the picul of copra, unfortunately predominates on Malayan estates; it is also least resistant to unfavourable soil conditions. The green type is to be preferred for hardiness and nut size, though its progeny are less uniform. The red type produces particularly poor copra.

290. TAMMES, P. M. L. 634.61

Tuinonderhoud bij klappers. (Maintenance of coconut groves.)

*Bergcultures*, 1938, 12 : 923.

The data obtained from trials of a number of systems of cultivation in North Celebes is examined. Green manuring has never increased the yield of copra and is therefore only recommended when its employment is likely to effect economy in other directions. In this event a permanent and cheap cover can be formed by sowing a mixture of *Calopogonium* and *Centrosema* to which has been added a sprinkling of *Pueraria*. The most economical method is the maintenance of a pasture and grazing stock under the palms provided the latter are old enough for the lower leaves to be out of reach of the cattle. In time it becomes a profitable side line and ensures sufficient draught being always available at harvest. The only attention required is a twice yearly cutting of the weeds not grazed down, and maintenance of the barbed wire fencing. There is, however, no evidence of increased yields attributable to this practice. The application of fertilizers has only proved profitable when there has been a deficiency in potash and phosphates and an increased yield of 10 nuts per tree has been possible. Clean weeding for a year has produced results on exhausted soil equal to those obtained from manuring. This cannot be carried out on sloping ground on account of erosion and is probably not worth while on land already in good heart. Occasional ploughing has given no crop increase. Drainage is absolutely

necessary on wet low ground and no coconut plantation can be expected to succeed on such sites without it.

291. JAGOE, R. B. 634.61-1.874  
**The effect of lalang grass (*Imperata arundinacea*) on growth of coconut palms.**

*Malay. agric. J.*, 1938, 26 : 369-75, bibl. 31.

Experiments carried out on plots of young coconuts in Malaya confirmed the widely held opinion that a ground cover of lalang grass reduces growth and yield. The controls were clean weeded plots and plots carrying a creeping leguminous cover (*Centrosema pubescens*). The feeding roots of the coconuts on the lalang plots were found to be greatly restricted, and the poor development of the palms is probably due to the limitation in the uptake of nitrates imposed by these conditions. The stiff, close nature of the soil was possibly a contributing factor.

292. BLISS, D. E. 634.62-2.19  
**Spoilage of dates as related to management of the fruit bunch.**

*Pap. Univ. Calif. Citr. Exp. Sta. 376,\* 1938*, pp. 7, bibl. 16.

This is reprinted from the report of the Fifteenth Annual Date Growers' Institute in Coachella Valley, 9 April, 1938. The term "spoilage" is defined as any condition in which the desirable qualities of the dates are impaired or destroyed. Experiments showed that fruit rot can be reduced by aeration. Aeration was obtained in three ways: (1) by fruit strand separation; (2) by bags which allowed increased ventilation of the fruit; (3) by the removal of fruit strands from the centre of the bunch. In moderately wet years all of these methods were effective in reducing the percentage of rot particularly when they were used in combination. In the years when no rainfall occurred during the ripening season fruit rot was not decreased by these measures. When thinning, the removal of 50 to 60% of the total number of fruits per bunch is recommended. Wire rings to prevent closing of the hole left by the removal of the inner fruit strands proved to be very satisfactory in many ways.

293. BLISS, D. E. 634.62-2.44  
**Two new species of *Omphalia* which cause decline disease in date palms.**

Reprinted from *Mycologia*, 1938, 30 : 313-26, bibl. 8, being *Pap. Univ. Calif. Citr. Exp. Sta. 380*.

Cultures of two new basidiomycetes, which are considered to be the cause of the decline disease of date palms, were isolated from the roots of diseased date palms. These fungi do not fruit commonly in the open. A method is described by which sporulation was obtained on inoculated seedlings of *Washingtonia filifera* in the greenhouse. The development of sporophores was favoured by soil and air temperatures of 26°-31° C. and a relative air humidity of 92-8%.

294. THOMPSON, A. 634.668-2.4  
**A root disease of the durian tree caused by *Pythium complectens* Braun.**

*Malay. agric. J.*, 1938, 26 : 460-4, bibl. 6.

An often fatal root disease of durian (*Durio zibethinus*) is described from Penang and Singapore. The disease is shown to be caused by the fungus wound parasite *Pythium complectens* Braun. acting as a facultative parasite on the roots of trees growing in soil of reduced fertility. In addition to the usual methods of treatment of root diseases a reconditioning of the soil is recommended which would in this instance include the prevention of erosion.

295. PARHAM, B. E. V. 634.771  
**Notes on the banana industry in Australia.**

*Agric. J., Fiji*, 1938, 9 : 1 : 4-13.

A brief account is given of the cultivation of bananas and the control of their diseases in New South Wales and Queensland.

\* Being reprinted from the Report of the 15th Annual Date Growers' Institute.

296. WARDLAW, C. W. 634.771-2.1/4  
**Banana diseases. XII. Diseases of the banana in Haiti with special reference to a condition described as " plant failure ".**  
*Trop. Agriculture, Trin., 1938, 15 : 276-82.*  
 " Plant failure " is the provisional name given to a condition prevalent in newly established banana plantations in Haiti. The result is a serious lowering in production of quality export fruit. The symptoms, which are described at length, may be briefly summarized:—Debility or death of many leaves, thus affecting the filling out of the bunch. The lower leaves of young plants become prematurely yellow and then brown; in older plants yellow and discoloured leaves develop in acropetal succession, secondary fungus and insect attacks follow. Discoloration and twisting particularly along the midrib and at distal end of leaves with a southern exposure to sun. In the second or third year the leaves of adult plants are reduced in size and form an erect cluster round the throat; in Gros Michel the typical waxiness of its leaves is often absent. A typical black mark appears where the petiole of the affected leaves joins the pseudo-stem and is associated with localized waterlogging of the petiole-pseudo-stem tissue and accompanied by micro-organisms of the soft-rotting fermentation type. As a result in time the pseudo-stem becomes pale green or yellow. The bunches when produced are short-fingered, light of weight and irregular in symmetry. The feeding roots, i.e. the fine laterals, but not the thick main roots, show injury consistent with the action of sour and adverse soil factor. Toxicity exercised by the high alkali (?) bicarbonate content of the soil and/or inadequate supplies of essential minerals seems to be the most likely of the several contributory causes rendered possible by the environment. Experimental work for the remedying of these conditions is advised. Alkali chlorosis, found in many districts, is considered to be an intensified form of plant failure. The symptoms are described. *Cercospora* leaf disease is present in varying degrees of intensity with the exception of the final or epidemic stage; this may come eventually, though the low humidity, low rainfall and short dew period may hold it in check. Panama disease (*Fusarium oxysporum cubense*) is present but not prevalent, except in one district. Bacterial wilt disease (*Bacterium solanacearum*) is less than in Trinidad. *Marasmus* stem rot (*M. semiustus*) was observed where flooding had been followed by very dry conditions. Heart rot from the infection of damaged leaf stalks and injured heart leaves were fairly numerous in some districts. There are indications that prevailing soil conditions may be contributory factors. Cigar end (*Stachylium Theobromae*) characterized by a rotting of the fruit tip in the plantation occasionally occurs on Gros Michel, the main Haitian banana (usually it is described as chiefly affecting Cavendish). It is commercially unimportant in Haiti. Sun scald occurs in certain districts in the form of severe scalding and cracking at the bend of the main stalk. " May " bunches, the Canary Island name for irregularly developed bunches characterized by twisted fingers, are common and are ascribed to unfavourable soil and climatic conditions. Several economically unimportant leaf diseases were also found. Purple scale (*Chrysomphalus personatus*) and a white scale caused considerable damage in some areas. Virus heart rot disease was observed. It is a virus disease which has done much damage in Australia and in Guadeloupe. The vector, the aphis *Pentalonia nigronervosa*, was also observed in Haiti and given favourable conditions the disease might become widespread. All cases should be immediately eradicated by the gas oil treatment (as for Panama disease) and the disease should be made notifiable. A virus disease well known in the West Indies which produces streaky leaf mottling but without heart rot was also noted on the green-red banana. Thrips (*Frankliniella insularis*) causes pinhead spotting of the fruits. The insect moves from leguminous crops to the banana when the bunch is in course of formation.

297. MAGEE, C. J. 634.771-2.48  
**Banana leaf spot.**  
*Agric. J. N.S.W., 1938, 49 : 662-4.*

Banana leaf spot (*Cercospora Musae*) was almost completely controlled in New South Wales by the application of 5 sprays of bordeaux mixture at monthly intervals during the summer. Even the application of 2 sprays at intervals of 1 or 2 months gave a considerable degree of control.

Promising results have been obtained by the use of copper sulphate dust, 5 applications of dust being equal in results to 2 bordeaux sprayings.

298. CALDWELL, N. E. H. 634.771-2.73

**The control of banana rust thrips.**

*Qd agric. J., 1938, 50 : 144-63, 295-316, 422-49, 576-84, bibl. 18.*

The history, importance, bionomics and control are discussed of the banana rust thrips (*Scirtothrips signipennis* Bagnall) with special reference to Queensland. In control the best results were obtained from repeated treatment of the bunch with nicotine dusts particularly when the bunches were encased in bags of 11 oz. sugar hessian to which were added fortnightly doses of nicotine dust throughout the life of the bunch. A single experiment in which the dustings were restricted to 3 given at weekly intervals early in the life of the plant produced equally good results.

299. BIRKINSHAW, F. 634.774

**Pineapples.\***

*Malay. agric. J., 1938, 26 : 321-7, bibl. 14.*

The principal varieties of pineapple (*Ananas sativus*) grown for canning are Smooth Cayenne in Hawaii and Queensland, Queen in Malaya and S. Africa, Red Spanish in Florida, Cuba and Porto Rico. Considerable variation is shown in quality and type especially in Queen and Smooth Cayenne. However, in most pineapple countries precautions are taken for limiting the propagation of undesirable types. The principal diseases affecting pineapples are various forms of "wilt" often affecting large areas. The primary causes are various and often difficult or, so far, impossible to determine. Hawaii, Malaya and Formosa produce the heaviest output of canned pineapples, the methods of Hawaii being especially remarkable for their great efficiency in all details.

300. COOMBES, A. N. 634.774-1.8

**A manurial trial with pineapples.**

*Leaf. Ser. Mauritius Dep. Agric. 42, 1938, pp. 6.*

A manurial trial on the effect of increasing doses of nitrogen on yield in Smooth Cayenne pineapple was laid down at the Central Experimental Station, Réduit, in February 1936. The ground had been under sugar-cane from 1932 to the end of 1934, after which *Phaseolus lunatus* was sown : this was ploughed in just before planting the pineapple. Planting was in double rows 20 in. apart between plants and rows and 4 feet between double rows. The plots were separated by border rows which did not receive any fertilizers. The four treatments given were no nitrogen, 163 kg. sulphate of ammonia per acre, 238 kg. ditto per acre, and 331 kg. ditto per acre. All plots received in addition a basal dose of P and K at the rate of 262 kg. phosphatic guano and 187 kg. sulphate of potash per acre. Notes were made on cropping, disease incidence, grades and returns in the period May 1937 to February 1938. Results which, it must be remembered, are for one experiment only, were greatly in favour of the highest dose of nitrogen. It not only produced a bigger "short season" crop and a few fruits later in the main fruiting season, but also fruits with a greater mean weight and showing a greater percentage of grade A.

301. DE VAHL DAVIS, G. 634.774-1.8

Die Bedeutung einer Volldüngung für die Ananaskultur in Queensland, Australien. (The importance of balanced manuring in pineapple growing in Queensland.) [English summary  $\frac{1}{2}$  page.]

*Ernähr. Pfl., 1938, 34 : 314-6.*

Contrary to established opinion, land that had been planted twice with pineapples can be restored by adequate cultivation and manurial treatments. The field in question (Palmwoods, Queensland) had been first planted with this crop in 1920 and again in 1926. The last crop was taken off in autumn 1932. The land was then ploughed over and until the winter of 1934 carried

\* Report for the 12th Int. Hort. Congr., Berlin, Aug. 1938.

the following cover crops:—cowpeas, Poona beans, and a mixture of golden vetch and blue lupins, which were ploughed in as green manure. Moreover, sulphur was applied to the soil at the rate of 750 lb. per acre in order to produce a soil reaction favourable to pineapples. Planting took place in the summer of 1934. In order to study the effect of manuring on the yield and quality of the fruit an experiment was laid down on part of the newly planted land. The following treatments were given:—(1) Unmanured; (2) 6 cwt. superphosphate+10 cwt. sulphate of ammonia per acre; (3) 6 cwt. superphosphate+10 cwt. sulphate of ammonia+4 cwt. sulphate of potash per acre; (4) 6 cwt. superphosphate+10 cwt. sulphate of ammonia+4 cwt. muriate of potash per acre. The fertilizer was applied partly in autumn, partly in spring. No crop was taken off in the first winter. The plants on plots receiving potash usually developed better, and produced in the summer of 1936, when the first crop was harvested, fruits that were much superior to those from other plots both in size, shape and colour, and chemical composition. The influence of potash was not however confined to the improvement of quality but also resulted in substantial yield increases, and in a higher degree of resistance to physiological diseases and pests. The sulphate form proved superior.

### STORAGE.

302. PHILLIPS, W. R. 664.85.035.1  
**The application of controlled atmospheres in the storage of fruits.**

*Sci. Agric.*, 1938, 19 : 66-8.

Recent work in Canada on the gas storage of McIntosh apples is briefly summarized. The importance of gas storage for this variety is stressed because McIntosh develops core flush at the usual cold storage temperature of 32° F. yet holds its appearance sufficiently to permit of marketing after it has deteriorated internally. Since there will shortly be a heavy increase in production (60% of all young non-bearing commercial apple trees in Quebec are McIntosh), it is important that no prejudice against this apple should be created in the mind of the potential consumer. The results of investigations so far indicate that for maximum quality a well-flushed, well-matured, medium-large (2½ in. to 3 in.) fruit should be used. The storage atmosphere giving the best results was found to be  $7 \pm \frac{1}{2}\%$  CO<sub>2</sub> and  $14 \pm \frac{1}{2}\%$  O<sub>2</sub> at 39° F. No core flush developed in the gas-stored apples while from 20-25% was found in those stored normally at 32° F.

303. PARHAM, B. E. V. 664.85.037  
**Recent advances in the cool storage treatment of fruit.**

*Agric. J., Fiji*, 1938, 9 : 1 : 13-18, bibl. 2.

The article contains nothing that has not already been fully and frequently dealt with in the literature, but it does form a concise summary of the varied storage requirements of commercial tropical fruits in their transport to the consuming countries. The importance of precooling and the necessity for establishing pre-cooling plants in Fiji is stressed.

304. GRAMPOLOFF, A. V. 535.21 : 664.85+664.84  
**L'action des rayons ultra-violets sur l'entreposage des denrées périssables.**  
**(The effect of ultra-violet rays on the storage of fruit and vegetables.)** [French and German summaries.]

Reprinted from *Annu. agric. suisse*, 1937, pp. 1130-58, bibl. 44.

Further experiments with ultra-violet rays (for previous trials see *Ibidem* 1936, pp. 953-77, *H.A.* 8 : 275) lead the author to the following conclusions: Irradiation of stored products at 4° C.-8° C. results in a decrease in loss due to moulds. The same result is achieved in green tomatoes stored at an average temperature of 15° C. No changes in taste due to excessive light treatment were noticeable. The influence of ultra-violet light on the coloration process of green tomatoes has been established. The irradiation of agar cultures of fungi has frequently resulted in total sterilization. Some fungi show great resistance to the rays. In addition to the destructive effect a stimulating effect has sometimes been noticeable. Ultra-violet rays

weaken the growth of fungus in artificially infected tomatoes, but have some difficulty in checking the growth of the mycelium inside the fruit.

305. GORSHKOV, L. A. 664.85+664.84

**Storing fruits and vegetables in peat dust.** [Russian.]

*Fruits and Vegetables, Moscow, 1938, No. 10, pp. 23-4.*

Dry peat dust (below 30% humidity) has been found to be a very satisfactory and cheap packing material for grapes, apples, tomatoes, cucumbers, etc.

306. TINDALE, G. B., TROUT, S. A., AND HUELIN, F. E. 634.13-1.547.6+664.85.13

**Investigations on the storage, ripening and respiration of pears.**

Reprinted from *J. Dep. Agric. Vict.*, 1938, Vol. 36, pp. 34, bibl. 12.

Various problems connected with the storage of pears have been studied for some time by the Victoria Department of Agriculture. The results of the investigations may be summed up as follows: The optimum picking time for the main varieties was determined. Colour at this stage was found to be consistent, while pressure and chemical composition varied from year to year. The date did not vary by more than one week from year to year, therefore picking to a definite time-table is recommended. Pears picked at the optimum stage of maturity had long storage life and were of good quality on ripening. Most pear varieties ripened only at temperatures higher than 32° F. Leaving the pears in cool store after the termination of storage life resulted in mealiness, core breakdown and scald on removal to higher temperatures. The length of storage life was found to depend on variety, temperature of storage, maturity at picking time and the delay between picking and cooling. Delayed picking and delayed storage after picking reduced the subsequent length of storage life. The rate of changes during storage in colour, pressure, chemical composition and respiration was found to be dependent on the temperatures. At the termination of storage life at 32° F. most varieties had a trace of green colour and the pressure fell 4 pounds. The rate of respiration during storage increased until the climacteric was reached. Then it fell until in some cases there was no liberation of CO<sub>2</sub>. The death of the pear was characterized by the development of scald. The length of storage life of most varieties was approximately three-fifths of the time required by the fruit to reach the climacteric and two-fifths of the time till the development of scald in store. Removal of pears from store a considerable time before disorders appear is recommended. The minimum satisfactory ripening temperatures for the main varieties were found and are noted here. The length of the ripening process was found to be determined by the following factors: temperature, variety and conditions preceding the ripening process. Temperatures had a much greater effect in retarding the ripening of certain varieties over the range 45° to 37° F. than over the range 65° to 45° F. As during storage, changes in colour, pressure, respiration and chemical composition occurred during ripening. It is considered possible to utilize the fall of pressure during ripening as a means for forecasting the termination of storage life. Normal ripening was accompanied by increases in cane sugar, alcohol and acetaldehyde, but in abnormal ripening there was little change in cane sugar, and the alcohol increased more rapidly, reaching 0.1% at the onset of core breakdown. It was found essential that the Australian Williams Bon Chrétien pear should be conditioned or ripened under artificial conditions in England, since the usual warehouse temperatures at the time of its arrival are too low for the normal ripening of this variety. After a conditioning treatment of 2-3 days at 65° F., the Williams pear ripened satisfactorily subsequently at 45° F. For canning this pear should be packed green, cool stored and conditioned after removal from store if the prevailing air temperatures do not exceed 55° F. While there were no significant differences in wastage between the inner and outer layers of pears in the flat case more wastage occurred in the inner layers than in the outer layers of Williams pears ripened in standard boxes. The development of wastage may be delayed by unpacking the case before ripening. Storage at 32° F. in an atmosphere containing 5% CO<sub>2</sub> prolonged the life of 4 varieties by about 50%. Higher CO<sub>2</sub> concentrations in some cases resulted in brown heart. Readings were made of temperatures in different positions in ship cargo spaces loaded

with pre-cooled and other fruit before steady temperatures of 31° to 32° F. were reached. This was the case only after a considerable time. It is recommended for export to pick the pears in a hard green condition [a colour chart is included.—ED.] and to subject them to pre-cooling treatment as soon as possible after picking. For the overseas transport of pears the temperature of 31° to 32° F. is regarded as the most satisfactory. [From authors' summary.]

307. ESBJERG, N. 664.85.11  
 Forsøg med opbevaring af aebler. (**Experiments in apple storage I.**) [English summary 1 p.]  
*Beretn. Forsøksv. PlKult. Khb.* **316**, 1938, pp. 309-40, being reprinted from *Tidsskr. Planteavl.* **43** : 309-40.

Danish apple cold storage experiments in 1936-7 and 1937-8 are here briefly discussed. The results which are tabulated show the effect of size of fruit on condition after storage, and on incidence of scald, Jonathan spot, bitter pit and internal breakdown. The effects on fungus incidence of storing different varieties at different temperatures, 1.5° C. to 3.5° C., with and without pre-cooling are noted. Special note is also made of the incidence of internal browning.

308. PHILLIPS, W. R., MONRO, H. A. U., AND ALLEN, C. E. 664.85.11 : 632.944  
*Some observations on the fumigation of apples with methyl bromide.*  
*Sci. Agric.*, 1938, **19** : 7-20, bibl. 17.

Standard treatment for the control of insects in harvested McIntosh apples by fumigation with a proprietary fumigant containing approximately 7% methyl bromide and 93% carbon dioxide resulted in injury to the apples. The treatment was as follows:—Previous to fumigation the internal temperature of the apples was brought to 60° F. to render the insects susceptible to the fumigant. The fruit was then placed in a vacuum fumigation chamber of 30 cu. ft. capacity, held at 80° F. by steam heating. After creation of the vacuum the desired amount of fumigant was allowed to flow into the chamber, the gas being circulated by an electric fan running for 15 minutes at 15 minutes' interval. After 2 hours a routine air washing with two successive vacua of 3 in. absolute pressure was given following the restoration of pressure in the chamber to 27 in. absolute pressure. To determine the source of injury the variation and components of the standard treatment (ten in all) were used separately and are tabulated. The results as summarized show:—The standard treatment of methyl bromide fumigation was found to be lethal to insects feeding internally in apples. The residue of bromide was so slight as to be harmless to human beings. Under certain conditions methyl bromide under the various ways applied was found to cause both external and internal injury to the fruit. If, however, the apples were picked at the proper stage of maturity and are stored for 6 weeks at 32° F. or 39° F. (representing the extremes of commercial storage temperature) and the standard treatment used, no injury resulted. It is concluded that the damage is physiological rather than mechanical.

309. WEBER, A. 664.85.11 : 632.1/4  
*Aeblesygdomme i lagerrum. (**Storage diseases of apples.**)\**  
*Beretn. Forsøksv. PlKult. Khb.* **316**, 1938, pp. 341-53, being reprinted from *Tidsskr. Planteavl.* **43** : 341-53.

Brief illustrated notes on diseases of stored apples both organic and physiological.

310. WIANT, J. S. 664.84.61  
*Market-storage studies of Honey Dew melons and cantaloups.†*  
*Tech. Bull. U.S. Dep. Agric.* **613**, 1938, pp. 18. bibl. 14.

During the period 1931-3 five storage tests were made with Honey Dew melons and four with cantaloups. Results showed that Honey Dew melons were subject to a low-temperature

\* See also *H. A.*, 7 : 232.

† See also *H. A.*, 8 : 437.

breakdown that occurred after 2 weeks' storage at 32° F. to 34° F. and to a smaller extent at somewhat higher temperatures. Cantaloupes were not thus affected. Neither type of melon was found to store well at temperatures above 40° to 42° F. and rapid rotting occurred. A more detailed study was made in 1934-6. The investigation comprised 8 tests with Honey Dew melons in which 84 flats were used and 6 tests with cantaloups in which 63 crates were used. Low-temperature breakdown, which again did not occur on cantaloups, developed most abundantly on Honey Dew melons at 32° F. and 34° F. and to some extent at 36° F. to 38° F. It did not occur at either 38° F. to 40° F. or 40° F. to 42° F. The disease is described and illustrated. The decay of melons of both types was caused mainly by *Cladosporium cucumerinum*. This rot is also described and illustrated, and the relation between it and low-temperature breakdown is discussed. Data indicate that cantaloups removed from refrigerator cars can be held for over a week at 32° F. to 34° F. Honey Dew melons can be safely held for 2 weeks at either 32° F. to 34° F. or 36° F. to 38° F., and with certain lots, it is indicated, a still longer storage may be practicable. With both types of melon the effects of storage varied with the degree of ripeness, riper melons decaying much more readily. Periodic examinations of stored melons are recommended.

311. RAMSEY, G. B., WIANT, J. S., AND LINK, G. K. K.

635.34+635.61/3 : 632.1/4

**Market diseases of fruits and vegetables : crucifers and cucurbits.**

*Misc. Publ. U.S. Dep. Agric.* 292, 1938, pp. 74, bibl. 208.

Certain diseases of cabbage, Chinese cabbage, brussels sprouts, cauliflower, collards and kale, cress, horseradish, kohlrabi, mustard, radish, rutabaga and turnip, cucumber, muskmelon, pumpkin, squash, and watermelon are described and illustrated. Where known, control measures are recommended. This publication should greatly facilitate the market inspection of the above named fruits and vegetables and aid in reducing and preventing losses due to disease.

312. NATTRASS, R. M.

634.3-1.564-2.48

**Citrus wastage.**

*Leafl. Dep. Agric. Cyprus* 23, 1938, pp. 8.

The losses of citrus fruit in Cyprus are almost entirely due to the green and blue moulds (*Penicillium digitatum* and *P. italicum*). Under present conditions in Cyprus spores are always present in the air which contains also sufficient temperature and moisture to ensure their germination and growth given a suitable medium. The prevention of wastage is, therefore, mainly restricted to careful handling of fruit so as to avoid rind injury. The following rules are suggested for picking and packing:—Do not pick fruit wet with dew or rain. Use clippers and clip twice to prevent projecting stalk ends. Use suitable picking bags. Keep baskets clean, lined and free from rubbish. See that gloves are worn or finger-nails kept short and a skilled foreman in charge. Do not overfill baskets. Wilt in special room, preferably before taking to packing shed. Load lorries so as to reduce movement to minimum. Remove and bury fallen fruit. Keep packing shed clean, remove and burn refuse daily. Sterilize floor, walls, baskets, grading woods, etc., often. Make all packers wear gloves.

313. RAKITIN, YU.V.

635.64 : 547.313.2

**The use of ethylene for ripening tomato fruits.** [Russian.]

*Fruits and Vegetables, Moscow*, 1938, No. 10, p. 42.

A brief outline is given of the ethylene method of accelerating the ripening of green tomato fruits. A full description of the method now used in U.S.S.R. will appear in a manual to be published in the near future by the Institute of Plant Physiology, U.S.S.R. Academy of Sciences.

314. WALFORD, E. J. M. 635.64 + 664.84.64

**Studies of the tomato in relation to its storage. I. A survey of the effect of maturity and season upon the respiration of greenhouse fruits at 12.5° C.**

*Canad. J. Res.*, 1938, 16, Sec. C., pp. 65-83.

Tomatoes (Grand Rapids) were grown in the greenhouse at different seasons of the year (Canada), individual fruits were picked at various stages of maturity and continuous records of their respiration obtained at 12.5° C. It was found that the fruits of the late spring and summer went through the customary series of extensive changes in respiration rate as they ripened at the low temperature, and exhibited a lack of durability normal to this fruit. In contrast to this, the fruits of the late autumn, winter and early spring, if picked before the external appearance of red pigment, passed into a stable state in which ripening proceeded with but little change in respiration rate and with greatly enhanced duration of life at 12.5° C. [Author's summary.]

315. OUNSWORTH, L. F. 635.53 : 632.19 + 664.84.53

**Nutritional studies of celery in relation to certain physiological changes in cold storage.**

*Sci. Agric.*, 1938, 19 : 57-65, bibl. 20.

An extensive fertilizer experiment with celery was undertaken in 1937 by the Quebec Refrigeration Committee to ascertain the effects of different levels of nutrients on keeping quality in cold storage. The field experiment was based on a 4-8-16 fertilizer at the rate of 1 ton per acre, nitrogen being supplied as nitrate of soda and potash in the muritate form. Osmotic pressure, pithiness, colour and breakdown were recorded. Phosphorus treatments and period of storage proved highly significant to breakdown. Phosphorus requires careful adjustment. Nitrogen was less important though a fairly high level is desirable. Potash produced no significant differences. The best fertilizer treatment used was 8-8-16, though there were indications that 8-12-16 would have been even better.

316. RASMUSSEN, M. P. 658.8 : 634 + 635

**Some facts concerning means of transportation and methods used in marketing New York State fruits and vegetables.**

*Bull. Cornell agric. Exp. Sta.* 697, 1938, pp. 113.

The 939 growers under consideration in 12 important producing areas in New York State sold about 17% of their produce at the farm, 54% at country shipping points and local markets and 29% at large city markets. Of the city markets, New York received 75% of the produce. Almost 91% of produce (by weight) was moved to its first place of sale in motor trucks, 7½% by rail and the rest in growers' wagons. Speedier service, lower cost and better condition of produce on arrival are among the major reasons for the increased use of the motor truck.

317. MALLISON, E. D., AND PENTZER, W. T. 664.84.037

**Body icing in transit refrigeration of vegetables.**

*Tech. Bull. U.S. Dep. Agric.* 627, 1938, pp. 41.

The effects of placing ice with the loads in the body of the car in the case of lettuce, cauliflowers and green corn in transit from the west to east of the U.S.A. have been examined carefully and are here discussed. Lettuce reached the eastern markets in good condition when cooled quickly at the time of shipment by body ice. Body icing is also successful with cauliflowers in preventing browning of the jackets and wilting but does not prevent riciness, fuzziness and spreading of heads due to over maturity. As regards green corn results indicate that a minimum of 5-7 tons of top ice in addition to ordinary refrigeration and salt are necessary for car shipments of green corn during a transit period of 3-5 days.

318. SOUTH AFRICA, UNION OF. 634.1/7 : 382.6  
**Fruit production in the Union. Report No. 19. I. The 1934-35 deciduous fruit export season. II. The 1935-36 deciduous fruit export season.**  
*Bull. Dep. Agric. S. Afr.* 182 (Plant Industry Series 28), 1938, pp. 139.

Statistical data are presented in tabular form of deciduous fruit exports from Transvaal, Orange Free State, Natal and Cape Province:—Eastern Districts, South-Western Districts and Southern Districts. Notes are included from the trade commissioner's weekly reports on shipments.

### PACKING, PROCESSING AND PLANT PRODUCTS.

319. HELSON, G. A. <sup>H.</sup> AND BENNETT, W. J. 631.564 : 634.1/7-2.95  
**The sterilization of fruit cases.**  
*J. Coun. sci. industr. Res. Aust.*, 1938, 11 : 140-2.

A steam sterilizer for fruit cases is described which fulfils the following conditions. It kills the pests ; it is economical ; it does not damage the cases ; it is completely automatic ; it can treat more cases per day than the packing house can empty. In addition the appliance cleans the cases, dries them quickly and removes all rubbish. Cocoons of the oriental peach moth and the codling moth are killed after one minute exposure in the sterilizer.

320. MINISTRY OF AGRICULTURE, LONDON. 631.564 : 634.1/8+635.1/7  
**List of authorized packers and registered distributors of national mark fresh fruit and vegetables.**  
*Marketing Leaflet. Minist. Agric. Lond.* 57A, 1938, pp. 65.

The list contains the name of packers and registered distributors for 14 kinds of fruit including rhubarb and tomatoes, and 26 kinds of vegetable.

321. MINISTRY OF AGRICULTURE, LONDON. 634.11-1.564+658.8  
**Notes on apple marketing season 1937-8.**  
*Notes for National Mark Packers* 19, 1938, pp. 10.

Notes are given of the amount of apples imported from U.S., Canada and Australia in each month of the year August 1936 to July 1937 and of the price obtained for these and for home grown apples. With regard to grading the following points are emphasized:—The packing down to a bare minimum of a grade should be avoided when possible. Where the proportion of Extra Fancy apples is small it will be probably wisest to include these in the Fancy pack. In a crop with a large proportion of Extra Fancy apples this grade should be used and a very clear distinction made between it and the Fancy Grade. This applies chiefly to cooking apples. When in doubt as to grading Extra Fancy or Fancy, grade Fancy. The possibility of "slack packs" and the cause of this are noted. One cause said to be new is the adoption of corrugated liners for sides and ends of boxes in addition to the usual top and bottom corrugated boards. These liners often stand up to the packing but yield to pressure afterwards and result in slackness. This phenomenon must be allowed for. The reader is referred to the Ministry's bulletin on apple packing.

322. MORRIS, C. C. 664.8.036  
**Canning fruits and vegetables.**  
*Ext. Circ. N.C. St. Coll. Agric.* 223, 1938, pp. 16.

Directions are given for steam pressure and hot water canning at home of fruits and vegetables in the Mountain Section of N. Carolina with notes on special points to be observed in canning particular fruits and vegetables.

323. FYLER, H. M., AND MANCHESIAN, J. T. 664.84.31+664.84.656 : 641.5  
**Effect of storage on leaching of minerals and nitrogen from asparagus and peas during cooking.**  
*Hilgardia*, 1938, 11 : 295-14, bibl. 18.

The investigations concern the effect of storage at 35° F. for various periods of time on the leaching of magnesium, calcium, phosphorus and nitrogen from asparagus (Palmetto) and peas (Giant Stride) when boiled or steamed, and on the crude fibre content. In both vegetables after all storage periods the amount of solids including sugars, starches, proteins and salts leached by boiling was 3 times (peas) or 4 times (asparagus) greater than that leached by steaming. The rate of leaching with asparagus, but not with peas, showed a marked initial increase during the first 48 hours of storage. In both vegetables with the exception stated there was a gradual decrease of leaching with increase of storage period. The crude fibre content of asparagus did not vary and that of peas increased with storage, the most rapid increase occurring during the first 24 hours.

324. WIEGAND, E. H., AND FENNER, K. P. 634.22+664.85.22.047  
**Dried Italian prune products.**

*Sta. Bull. Ore. agric. Exp. Sta.* 353, 1938, pp. 25.

Experiments have been made to find a use for the normal surplus production of fresh and dried prunes in Washington and Oregon. In this report notes are given on the following processes :—canning, converting dried prunes into a beverage by the addition of sugar and water, pitting Italian prunes by machinery to economize in freight costs, pulping small or irregularly shaped prunes for use in confectionery products, halving and pitting by machinery thereby producing prunes which retain some of the desirable characteristics of fresh prunes and can also be prepared for consumption very quickly.

325. C.A.S.B.\* 016 : 664.8.047  
**The drying of fruits and vegetables 1930-1937.** Being references to some 115 articles on drying of fruit and vegetables, especially sugar beet, 1938, (stencilled).

326. GRUNER, V. S. 634.3-1.56  
**Subtropical fruits in the confectionery industry.** [Russian, English summary 11 lines.]  
*Soviet Subtropics*, 1938, No. 10 (50), pp. 52-6.

Various citrus fruits obtained from the Sukhum Introduction Nursery, Batum Botanical Garden and the Grapefruit Collective Farm were tested for their suitability as raw material for confectionery purposes. The grapefruit jams were bitter, and no chemical soaking treatments were found to improve this condition. By boiling grapefruit peel in water or by soaking in 5% salt solution fine quality candied peels were obtained. The second method gave a better product. The results with shaddocks and lemons were similar to those obtained with grapefruit. Fine quality candied peels and jams were obtained from both ponderosa lemons and shivo-mikan fruits. Cooked limequats had also a fine flavour.

327. MALLOCK, J. G. 664.65 : 634.11  
**Note on the use of apples in bread baking.**  
*Sci. Agric.*, 1938, 19 : 83-4.

Apples in 3 different forms and in various proportions were added to an ordinary patent baker's flour for bread making. The forms were series I, as apple sauce (5-25 g. per 100 g.), cooked till all the added and part of the natural water had been evaporated; series II, pomace from partially pressed raw sliced apples (proportions as I); series III, the juice from the pressing in series II with corresponding reductions in the amount of added water in the dough (5-20 c.c. per 100 g.). Both raw apple series gave larger loaves than the cooked and all gave larger loaves

\* Central Agricultural and Scientific Bibliography, Science Museum, London, S.W.7.

than the control. Series III gave a whiter loaf and all kept better than the control. The flavour was pleasant and the toast palatable from either fresh or stale loaves. It is concluded that a very attractive speciality bread might be made by the addition of apples.

328. SAL'KOVA, A. K. 634.37 : 581.192  
**The biochemical value of figs.** [Russian, English summary 12 lines.]  
*Soviet Subtropics*, 1938, No. 10 (50), pp. 48-9.

Biochemical analyses were made of fresh and dried figs by the U.S.S.R. Institute of Plant Industry in order to determine the best Azerbaijan and introduced varieties as well as to study the influence of sun and artificial drying on their nutritive values. The varieties containing the largest amount of sugar are noted. Of the drying methods, sun drying proved the best. Treating with sulphur fumes prior to drying prevented the figs from becoming sour.

329. KOKHAS', T. 634.322 : 613.815  
**Mandarin juice.** [Russian, English summary 12 lines.]  
*Soviet Subtropics*, 1938, No. 10 (50), pp. 50-1, bibl. 1.

Experiments showed that mandarin juice profits greatly from the addition of some but not too much sugar, e.g. 20% would be excessive. Juice with 14.5% solid matter had the best flavour. 0.003% essential oil added to the juice improved its flavour, but further additions spoiled it. The juice may be pasteurized both by the interrupted and by the uninterrupted pasteurization process. The first method permits the use of the so-called "flash pasteurization", the essential part of which consists in heating up to 93°-98° C. with rapid cooling to 4° C. By this method the enzymes are destroyed, the aroma is preserved and the juice has no cooked flavour. This method is said to be similar to a sterilization process worked out by the Central Laboratory for electro-magnetic waves, which to the reader's disappointment is merely mentioned here. The other method of stabilization and preservation of mandarin juice is by the use of CO<sub>2</sub> at a pressure of 5.4-7.0 atmospheres at a temperature of 15° C.

330. VERHOEF, L. 668.44  
 Iets over harsen, in het bijzonder damar and copal. (**Resins, in particular damar and copal.**)  
*Bergcultures*, 1938, 12 : 516-23.

Many plant resins are produced in the Dutch East Indies principally the following:—copal from *Agathis* spp., damar from a number of trees belonging to the *Dipterocarpaceae*, benzoin from *Styrax* spp., camphor from two species of *Dryobalanops* and a resin is also obtained from *Pinus Merkusii*. The uses and present position of these in commerce is discussed and lines on which the products can be improved and their employment extended are suggested. Some notes on cultivation which is still in its beginnings are given. Of the *Dipterocarpaceae* several genera, *Anisoptera*, *Hopea* and *Shorea* among others, are sources of damar. There are difficulties in collecting a regular supply of seed, since this family, without exception, only fruits at irregular intervals and the seeds soon fall and are lost. No doubt some sort of rotation could eventually be established under plantation conditions. As it is, seeds must be obtained from afar and owing to their fatty nature need special packing to avoid deterioration, i.e. the entire fruits, not too ripe, should be packed in charcoal, when they will keep for some time. Young trees take 10 years to fruit from time of sowing. The trees require a climate without a prolonged dry season, and thus in Java can only be grown in the west. The soil must be permeable yet moist; they are in this respect true forest trees. They are not exigent as regards the chemical make-up of the soil. A light shade is necessary. *Agathis* has much the same requirements as the preceding, but is more tolerant. If seed is sent from a distance it should travel in the cone. Unfortunately a great quantity of cones are needed to produce a few viable seeds. Selection of *Agathis* will be difficult since a tree takes fifteen years to come into full bearing. There is, however, a marked difference between the bark of good and bad yielders and this should serve as a guide. [It is not stated what that difference is.—ED.] Differences in yield between individuals [presumably otherwise uniform] may be as much as 1 : 10. Unlike the two gums previously mentioned

benzoin (*Styrax*) is cultivated on a fairly large scale in certain districts, about 5,000 tons per annum being produced. The tree becomes tappable in its seventh year. The camphor from *Dryobalanops* spp. is obtained from chips taken off the tree. It differs somewhat in chemical composition from the synthetic and Japanese camphors but offers no special advantages and is harder. It has special local uses and is regarded as a fancy product without much future.

331. v.B. 635.64 : 633.913  
**Rubber uit tomaten schillen ? (Rubber from tomato skins ?)**  
*Bergcultures*, 1938, 12 : 861.

*De Westlander* of April 22, 1938, reports that Dr. Mauri of Parma has produced excellent rubber from tomato skins. From the 800,000 tons of tomatoes that Italy produces yearly 2,000 tons of rubber could be made. Great quantities of these tomatoes are used in the manufacture of tomato purée and sauce, and if the report is correct a useful outlet for the refuse of these factories seems to have been found.

332. PIDDLESDEN, J. H. 633.912-1.56  
**Experiments with a new type of smoke house.**  
*J. Rubb. Res. Inst. Malaya*, 1938, 8 : 258-85, bibl. 2.

Tests are described which resulted in the design of 2 smoke houses for rubber to dry 1,000 lb. and 2,000 lb. per day respectively. The designs are given in an appendix (pp. 272-85). Certain advantages are claimed for these new smoke houses; initial costs of construction are low, they can be built on sites where the water table is high, the furnace is simple and readily renewable without skilled labour; the operation is simpler and the colour of the rubber produced is more satisfactory than that of a Subur-type building. The difficulty of obtaining an adequate volume of smoke and a sufficiently dark colour on sheet dried with an exterior furnace seems to have been overcome.

333. VAN DALSEN, J. W. 633.912-1.56  
**Een nieuw rubber-poeder : Mealorub. (A new rubber powder, Mealorub.)**  
*Bergcultures*, 1938, 12 : 1663-7, bibl. 2.

The development, manufacture and uses of a new rubber powder, Mealorub, are discussed. The chief characteristics of Mealorub in relation to other rubber powders are a low propensity to stickiness and a high rubber content. The first characteristic is a great advantage in shipping and storage, allowing it to be packed in bales or sacks and to be easily cleaned, the second secures cheaper transport since more rubber is sent per volume than with other powders. The easy cleaning allows it to be used for purposes for which ordinary rubber powders are not suitable. In treating with solvents such as benzine, etc., Mealorub behaves differently to ordinary raw rubber, it does not become viscous but the particles swell and separate and can easily be rubbed to a fine powder between finger and thumb and entirely disappear if the quantity of solvent is augmented. It is in this way possible to break up the particles with rubber solvents into particles as small as those in latex.

334. BUCKLEY, T. A. 665.353.4 : 581.192  
**Carotene in palm oil.**  
*Malay. agric. J.*, 1938, 26 : 258.

The special dietary value of palm oil arising from its pigment, carotene, which is a precursor of vitamin A, is becoming increasingly recognized. The pigment, however, is an inconvenience in many industries and is, therefore, destroyed or removed from the oil. A method of extracting the carotene for future use with the aid of an activated earth has given favourable results and is briefly described.

335. HINCHY, V. M. 633.65

**The commercial production of sugar from the nipa palm.\***

*Malay. agric. J., 1938, 26 : 426-30.*

*Nipa fruticans* is a trunkless palm indigenous to the Philippines, Borneo and Malaya. The flower stalk grows to a height of 5 ft. from the ground and produces a fruit which matures in 6 months. The sugar juice is obtained by cutting off the fruit and allowing the sap to flow into a small earthenware pot hung on the cut end of the stalk. The wound is kept open and the flow continues day and night until the stalk is completely cut away. Inversion and fermentation of the sucrose is avoided by the use of preservatives (a dose of electrolytic chlorine by day and a lime solution from good stone lime at night) and juice is collected for transport daily to the factory. Here the juice is treated according to the established methods for sugar production. The sugar so produced is practically indistinguishable from that obtained from other natural sources. The nipa palm has advantages over beet and cane in continuing to yield indefinitely with, in addition, a constant increase of palms in the stands, so much so as to require periodic thinning out. Flowering and fruiting is continuous instead of seasonal. A great saving in cost over the other two sources is that no costly extraction plant is required, and the losses from sucrose in these mills, often considerable, is therefore eliminated, the juice entering the boiler house with 100% of its original sugar. With a distillery operating in conjunction with the factory the proportion of sugar and alcohol can be varied to meet market requirements. The production of alcohol from the raw material is simpler than from molasses and cheap. The remainder of the article is concerned with a technical account of factory practice in Malaya.

336. LAPIN, V. K. 578.65 : 668.52

**On the possibility of replacing *Oleum caryophylorum* in cytological work by some other essential oils.** [Russian, English summary pp. ½.]

*Trud. Inst. hum. Subtr. Sukhum, 1937, 1 : 4 : 75-8.*

In *Andropogon citratus* and *Monarda* oils good substitutes have been found for the imported carnation oil (*Oleum caryophylorum*) which has hitherto been used in U.S.S.R. for staining cytological preparations. Certain other plant oils have been also found suitable for objects with normal differentiation and for objects apt to immediate differentiation.

337. HARWOOD, L. W. 658.8

**Factors influencing the quality of copra in Fiji.**

*Agric. J., Fiji, 1938, 9 : 2 : 5-10.*

Remedies are suggested which it is thought would, if put into practice, have the immediate effect of improving the quality of copra from Fiji. They are mainly concerned with the adaptation of the accepted methods of other copra producing countries to the conditions of Fiji.

#### NOTES ON BOOKS AND REPORTS.

338. FORSCHUNGSDIENST. 634+635 : 581.08

**Forschung für Volk und Nahrungs freiheit. (Agricultural research and national food security in Germany.)**

*Forschungsdienst*, Sonderheft 8, pp. 625, publishers Neumann of Neudamm and Berlin, R.M. 25.

In this many-paged work, which was unfortunately published prior to the absorption of Austria and Czechoslovakia, the whole of German agricultural research based on its reorganization under National Socialism is reviewed. It is now organized into seven Imperial Work Communities (Reichsarbeitsgemeinschaften), that for Horticulture, pp. 336-428, under its chairman, Professor E. Maurer, dealing with all essentially horticultural problems and overlapping slightly

\* From *Int. Sugar J.*, 1938, 40 : 301-3, extracted from privately published mimeograph bearing the same title.

with the Pflanzenbau Community on the question of fibre, oil and protein-producing plants. This Community for Horticulture is subdivided into an indefinite number of so-called Arbeitskreise or work groups, each of which is concerned with one particular phase of horticulture. Each group has at its head a "Führer" or supervisor, and collaborating with him are several other workers, some of whom may be at the same Institute, others hundreds of miles away under quite different conditions. One man may thus be supervisor of one or more study groups and collaborator in others. Most of the problems under investigation are of general rather than local or particular interest. It would seem most useful to note the main groups, their supervisors and some of their chief aims.

1. **VEGETABLES.** 1. [IV/1]. *Vegetable breeding and varietal trials.* Supervisor: B. Husfeld,\* Institut für Züchtungsforschung, Müncheberg/Mark, Müncheberg, with collaborators at 4 centres. Tomatoes resistant to *Cladosporium fulvum* have been evolved. Breeding and selection work is in progress on various types of cabbage, brussels sprouts and kohlrabi.

2. [IV/8]. *The effect of environment on vegetable cultivation.* Supervisor: J. Reinhold, Staatliche Versuchsanstalt für Gartenbau, Pillnitz/Elbe, with collaborators at 8 centres. Experiments are in progress to determine how and to what extent soil and climate affect the yields of cabbage, celery, carrots, onions and spinach. At Bonn different types of glass for glasshouses and different types of artificial lighting are being tested from a cultural and economic standpoint. Results with glass have not varied but those with artificial lighting have varied greatly with species of plant and type of apparatus. Mulching experiments at nine centres with a specially impregnated wood-wool have yielded negative results.

3. [II/6]. *Vegetable manuring.* Supervisor: F. Vogel, Staatliche Versuchsanstalt für Gartenbau, Weihenstephan, Post Freising bei München, with collaborators at 4 centres. This group is conducting trials on the general and particular results of manuring vegetables. Under the latter heading may be classed investigations on the effect of manuring and of particular manures on such qualities as flavour, size, firmness, compactness, consistency, colour, disease resistance, etc. Certain results already obtained with cabbage, cucumber and celery are noted.

4. [IV/11a]. *Vegetable storage for market gardeners.* Supervisor: J. Reinhold, Pillnitz/Elbe, with collaborators at 4 centres. Results to date show sand to be the best medium in which to store vegetables during the winter. The existence of a relationship between head weight and storage capacity in cabbage has been established.

II. **FLOWER GROWING.** 1. [IV/7]. *Breeding and selection in floriculture.* Supervisor: B. Husfeld,† Müncheberg/Mark, with collaborators at 5 centres. Important work on rose rootstocks with special reference to the production of roses under glass is being done at Berlin Dahlem. The search is being made for a carnation with medium-sized flowers and other good characteristics in addition to that of free flowering during the winter. Research is in progress on *Primula obconica* with the object of producing a primin-free type, and on *P. malacoides* for general improvement. Tulips are also under investigation.

2. [IV/10]. *The effect of environment on the cultivation of ornamentals.* Supervisor: F. Vogel, Weihenstephan, with collaborators at 2 centres. The word environment would appear to include nearly everything that can and does affect the growth of the plant. Thus the ordinary garden pot has been submitted to careful examination and it has been found that air permeability of the pot is a much more important factor for plant growth than water porosity. Other trials include uspuln treatment of tulips, spacing of tulips, soil and fertilizers for carnations growing in different media, and for chrysanthemums, hydrangeas and primulas and composts for gloxinias.

III. **MEDICINAL PLANTS.** 1. [I/21]. *The production and improvement of medicinal plants.* Supervisor: W. Rudorf, Müncheberg/Mark, with collaborators at 12 centres. The influence of climate and soil on yields and chemical composition of medicinal plants is being widely studied. Comparative trials are in progress with different strains of caraway and mustard. Other work in progress includes breeding for particular qualities, methods of preparation and extraction, special trials on collected material, growth under extremes of climate, etc., and nutritional requirements.

2. [II/5b]. *Manurial trials with medicinal plants.* Supervisor: K. Boshart, Landesanstalt für Pflanzenbau, Munich 23, Königinstr. 36,

\* Present supervisor (correspondence Feb. 1939) J. Reinhold, Pillnitz/Elbe.

† Present supervisor (correspondence Feb., 1939) Dr. Kappert, Inst. Vererbungsforschung der Universität Berlin, Berlin Dahlem, Schorlemer Allee, 25/27.

with collaborators at 4 centres. On the whole response to fertilizers has been found to consist in greater yield coupled with slightly lower percentage of essential oil, the increased yield more than balancing this loss. IV. FRUIT. Fruit is the object of research by several groups and sub-groups among which the following may perhaps be considered the most important:—  
 1. [IV/9a]. *Ecological investigations*. Supervisor: E. Kemmer, Institut für Obstbau der Universität Berlin, Berlin-Dahlem, Königin-Luise-Str. 22, with collaborators at 2 centres. The effects of local climatic conditions on fruit tree growth are being studied at different points in a network of well-equipped ecological and meteorological stations throughout the country.  
 2. [IV/3]. *Pollination of pome and stone fruits*. Supervisor: C. F. Rudloff, Staatliche Versuchsanstalt für Wein- Obst- u. Gartenbau, Geisenheim am Rhein, with collaborators at 7 centres. Notes on the various aspects of pollination, e.g. self- and inter-sterility, incompatibility as affecting cherries, apples, pears and other fruits are given here.  
 3. [IV/2]. *Breeding for disease and pest immunity*. Supervisor: B. Husfeld,\* Müncheberg/Mark, with collaborators at 3 centres. The resistance of the apple to woolly aphid has been successfully studied. It is found that in resistant varieties following inoculation no activation of the cambium takes place, but necrotic cells appear in the direction of the xylem and phellogen-like tissues towards the phloem. No gall tissue at all is formed. This phenomenon, which can be observed after 5-7 weeks, is said to offer a rapid method of determining resistance in seedlings. Breeding for scab resistance in both apples and pears is in progress. Further it is hoped to produce cherry varieties immune to the brown rot fungi *Sclerotinia-Monilia* spp., and certain non-susceptible seedlings are now under observation. As regards small fruits the pursuit of a mildew-resistant gooseberry continues, and so far as *Gloeosporium Ribis* is concerned it may be noted that *Ribes alpinum* is resistant to it.  
 4. [IV/4]. *Rootstocks*. Supervisor: E. Maurer, Institut für Gärtnерischen Pflanzenbau der Universität Berlin, Berlin-Dahlem, Königin-Luise-Str. 22, with collaborators at 5 centres. Roughly the different aspects of the problem are being investigated as follows:—(i) propagation and selection at Berlin Dahlem, Halle and Pillnitz, (ii) type characters at Berlin Dahlem. [In this connexion attention must be drawn to Maurer's recent excellently produced book, *Die Unterlagen der Obstgehölze*, see abstract 339], (iii) grafting trials at Berlin Dahlem, Pillnitz and Jork, (iv) effect of intermediate stem piece at Halle, Weihestphan and Jork, (v) effect on yield at Berlin Dahlem, Halle and Pillnitz. The possibilities afforded by the use of selected seedlings are also being examined at Berlin Dahlem by Kemmer [see H.A., 8 : 676]. One of the problems under investigation in this connexion is the propagation of the walnut, on which Kemmer reports here [see H.A. 8 : 721]. In addition to the groups whose activities are noted above two others exist namely for the study of fruit storage on the farm, [IV/11b], supervisor: E. Kemmer, Berlin Dahlem, and for plant protection, [IV/13d], supervisor: Noll, Staatliche Versuchsanstalt für Gartenbau, Pillnitz/Elbe.  
 V. VITICULTURE.  
 1. [IV/5]. *Grape vine breeding*. Supervisor: B. Husfeld, Müncheberg/Mark, with collaborators at 6 centres. The work is divided into 6 sections each of which deals with one of the following problems:—(1) Breeding of European vines to get varieties tolerant of particular climates; (2) breeding rootstocks with good soil affinity, ease of grafting and resistance to disease and to phylloxera; (3) breeding direct producers; (4) breeding for immunity to *Plasmopara viticola*, *Oidium Tuckeri*, *Pseudopeziza tracheiphila* and *Phylloxera* spp.; (5) special breeding of American × European strains relatively resistant to phylloxera; (6) photoperiodism in vines.  
 2. [IV/6]. *Grafting and budding*. Supervisor: W. Heuckmann, Berlin SW3, Dessauer Str. 12<sup>111</sup>, with collaborators at 5 centres. The aim is to get a higher percentage of take and reduce the cost of production.  
 3. [IV/12]. *Vine diseases and their control*. Supervisor: F. Stellwaag, Staatliche Versuchsanstalt für Wein- Obst- u. Gartenbau, Geisenheim am Rhein, with collaborators at 5 centres. In addition sub-groups are investigating ripeness in grapes in relation to time of picking, and assimilation and transpiration problems.

N.B. —The numbers in square brackets are the official numbers of the different groups. The supervisors change from time to time. Corrections up to February 1939 are included as footnotes. For them the abstractor is indebted to Prof. Rupprecht of Berlin Dahlem.

\* Present supervisor (correspondence Feb., 1939) Dr. Rudorf, Müncheberg/Mark.

339.

MAURER, E.

631.541.11 : 634.1/2

Die Unterlagen der Obstgehölze. (**Rootstocks for fruit trees.**)

Paul Parey, Berlin, 1938, pp. 379, bibl. 356, R.M. 20.

The inevitable comment of most English workers on looking through this monumental work is likely to be, "if only it were in English"! Even so they will be grateful for many features including the following:—354 illustrations and 14 coloured plates, uncrowded and clear lay out of pages, simplicity of language, use of Latin and not Gothic characters, and choice of methods of rootstock identification by vegetative characters. A very little German will go a long way towards obtaining the full benefit of the book.

First, in a brief, easily read, historical review, the author transports us from the Hanging Gardens of Semiramis to the present day. Next he deals with the importance of rootstock influence and the results of research with regard to all the common deciduous tree fruits, noting how German research work of the present day is linked up with practice and how rootstocks are tested not merely at one centre but under very different soil and climatic conditions in different parts of the Reich.

In the third part, pp. 83-352, will be found the fullest description so far available of the outward, physical characteristics of all the well-known clonally reproduced apple, quince and plum rootstocks used in Northern Europe at the present time.

Identification keys based on the summer characters of quince and plum rootstocks and the summer or winter characters of apple rootstocks are given for all the numbered stocks. The primary differentiation is based on colour of bark, colour of lenticels and shape of leaf, thus differing from that adopted by Floor and Zweede (*Handleiding voor de determinatie van appelonderstammen, H.A., 7 : 523*) in which the primary distinction is based on the ratio of leaf length to breadth. The decision can then be checked by reference to the illustrations. It may be useful to consider in detail some of the illustrations which form such a valuable feature of the book. On pages 126-35 are silhouette or outline leaves of the different apple types I-XVIII and Northern Spy. These give a clear idea of leaf-shape, apex, base of leaf and serrations. They are followed by photographs of the summer shoots which show well the general appearance and pose of the leaves in relation to the stem. Used in conjunction with the leaf outlines these should be extremely useful for identification purposes. Illustrations of apple stool beds show clearly the comparative vigour of the different types in the stool bed. Illustrations are also given of the winter buds, "close ups" in black and white in twice natural size, and half-size reproductions of shoots in natural colour. Both of these show many well-marked node and lenticel characters which would certainly help in identification. The reproduction in colour is obviously difficult and all credit is, therefore, due to the author for being the first to introduce it into descriptions of rootstocks. The illustrations of the rooting of layers (or shoots) off stools are fairly representative of phenomena observed in England. Quince and plum rootstocks are similarly illustrated with equal success.

The photographs of 4-6 year specimens of the different rootstocks of all the fruit species growing on their own roots afford an excellent idea of their natural habit and vigour, and the bearing and appearance of their own fruits on the branches of these stocks are excellently recorded and are very characteristic. There are also coloured plates of individual fruits.

It is interesting to note that Professor Maurer differentiates between so called type XVII and type V apple rootstocks. Floor and Zweede in *Handleiding voor de determinatie van appelonderstammen* write with regard to type XVII, "At the beginning of this classification it was necessary at Wageningen, because of certain differences in character, to allocate to this type a separate number. In later years it appeared that there was no morphological difference to be found between type XVII and type V. For the moment material of both types is still under observation in order that any differences in the stock/scion reactions may be ascertained. The type number XVII therefore will be reserved and will not be given to any subsequent type that may be added to the series." Professor Maurer, however, while finding them nearly identical in winter characters finds slight differences in their shoot growth and other summer characters as also in their root systems.

The last short section is devoted to an account of stooling and layering propagation methods. We are extremely grateful to Professor Maurer for this delightful and helpful work.

340. INTERNATIONAL INSTITUTE OF AGRICULTURE. 338 : 63 : 016  
*International bibliography of agricultural economics*, 1938, Vol. 1,  
 No. 1, pp. 137. International Institute of Agriculture, Rome, Villa Umberto I.  
 30 liras It. or 6s. 6d. a year of 4 numbers.

A perusal of this latest venture of the International Institute of Agriculture brings a pleasant surprise. There seems no reason why it should not fill a long felt want for a periodical list of articles, books, conference reports, etc., on the economic aspects of agriculture. Hitherto they have, so to speak, been no one's child. Frankly, how can an abstracting journal deal with valuable but quite unabstractable articles as "California fruit and nut crop estimates for 1937" or "Fruit supplies 1937"? Yet they must be noted somewhere, since at any time the agricultural organizer may want to refer to just such articles. The resources of the Institute's library give it unique opportunities for such a compilation and the fact that the work of selection of the material is in the hands of its able and level-headed librarian is a guarantee that there will be no scamping. We welcome the publication and commend it to the notice of directors of agriculture.

341. KRASINSKY, N. P. 631.588.1+612.014.44+631.829  
*Methods of forcing flowering plants*. [Russian.]  
 Govt. Publishers of State and Collective Farm Literature, Selkhozgiz, Moscow,  
 1937, pp. 136.

The book is devoted to the application of electric light, to carbon dioxide as fertilizer, and to the influence of photoperiodicity on practical ornamental gardening. A general survey of literature is followed by a report of the author's experiments in Moscow with the following plants which received special light and CO<sub>2</sub> treatment: *Cineraria hybrida*, *Matthiola annua* and *M. incana*, roses, *Hydrangea hortensis*, *Primula*, *Lillium*, *Cyclamen*, *Aster chinensis* and *Antirrhinum majus*. In most instances positive results were obtained both from light and CO<sub>2</sub>. It has been shown that 500-watt bulbs produced light of sufficient intensity and the most convenient reflectors are described. Photoperiodic experiments were carried out with 10 varieties of *Chrysanthemum indicum*, 1 var. *Salvia splendens*, *Perilla*, *Poinsettia*, *Begonia Gloire de Lorraine*, *Coleus*, *Aster sinensis* (2 vars.), *Hydrangea hortensis* (2 vars.), *Cineraria*, *Pelargonium*, *Primula obconica*, *Lobelia* and *Dahlia* (2 vars.). Technical instructions for practical use of the new facts are given. The book closes with a discussion of the biochemical changes during photoperiodic reactions and the influence of ethylene and acetylene on root formation.

J.S.

342. ASTOR, VISCOUNT, AND ROWNTREE, B. S. (EDITORS). 635 : 631.16  
*Small holdings studies*, being reports of surveys undertaken by some agricultural economists.

Longmans, Green & Co., London, 1938, pp. 189.

Reports are given of the economic working of small holdings in the Evesham district, in the south-west of England, in Wales, Scotland, Lancashire, Yorkshire and Cambridgeshire. Some of these are largely horticultural, others do not touch horticulture. A table of contents could have been compiled in five minutes and would have added greatly to the ease of consulting the different sections, all of which contain useful information.

343. MINISTRY OF AGRICULTURE, LONDON. 634.11-1.546-1.541.11/12  
*Intensive systems of apple production.\**

*Bull. Minist. Agric. Lond.* 49, 1938, 4th edition, pp. 40, 1s.

Before reissuing this bulletin the Ministry have taken the opportunity of submitting it to the leading fruit investigators. Their suggestions and alterations are incorporated. The sections on rootstocks, on nutrition and pollinating have been significantly altered to agree with the latest knowledge on those subjects. Notes on pruning are also slightly expanded.

\* For 3rd edition see *H.A.*, 6 : 996.

344.

MINISTRY OF AGRICULTURE, LONDON.

**Tree fruits.***Bull. Minist. Agric. Lond.* 2, 1938, 3rd edition, pp. 115, 2s. 6d.

This bulletin which was last published in 1935, see *H.A.*, 5: 324, has been very thoroughly revised. It forms an almost indispensable guide for the progressive grower and the horticultural advisor. The section on propagation contains the last word on rootstock selection, clear and well illustrated instructions for grafting and budding and a full account of the so-called framework process suitable when a quick change of varieties in an orchard is desired. The new section devoted to management deals very briefly with soil treatment and with pruning. Advice on pruning has been brought into line with the latest observations of research. A short note is given on ringing shy fruit formers. The task of variety selection is made somewhat easier by the elimination of a considerable number of varieties, the tendency nowadays being for large plantings of few varieties. The merits of different apple, pear, plum and damson, cherry, peach, nectarine and cider apple varieties are discussed and a note is given of the national fruit trials at Wisley established to test new varieties against old. In view of this tendency to plant few varieties, the section on pollination is very welcome. In it the problems involved in planting to ensure adequate pollination are discussed and practical advice given on how to solve them. Control of diseases and pests is dealt with concisely but very shortly and for more detailed knowledge the reader is referred to current literature on the subject and to the publications of the English research stations. Short notes are given on the ways in which established orchards can be improved. Since moreover with increased storage facilities the problem of handling fruit has become more urgent, notes are included on the harvesting and storage of fruit and reference is made to the recent advances in gas storage. Finally under marketing the various National Mark Schemes for apples, pears, plums, cherries, cider, perry and fruit products are very briefly outlined.

345.

MINISTRY OF AGRICULTURE, LONDON. (TURNBULL, J.)

**Commercial apple production.***Bull. Minist. Agric. Lond.* 111, 1938, 1st edition, pp. 56, 1s. 6d.

This bulletin deals with the large-scale production of commercial apples in England. The English market now absorbs some 10-12 million cwt. of apples of which in some years more than half are imported. The varieties home produced are mainly culinary, Bramley's Seedling predominating. The chief apple growing areas are Kent, Essex, the West Midlands (mainly Hereford but also parts of Worcester and Gloucester), and the West Country, namely Somerset and Devon (cider apples predominating). Although extremes of sunshine and rainfall are not experienced in England, these two factors probably play an important part in the distribution of apple areas in England. Soil surveys of England have shown that fruit growing appears to fail under only two soil conditions, namely waterlogging or extreme sandiness, the effects of the latter being rectifiable only by large and uneconomic potash manuring. As regards altitude good plantations are found at all altitudes from sea level to above 400 ft. The author's remarks on stocks are somewhat guarded, but it is suggested that according to circumstances the grower may choose seedlings or one of the vegetatively produced stocks such as I, II or IX. Varieties of proved excellence are culinary, Bramley's Seedling, Lord Derby, Grenadier, Arthur Turner and possibly King Edward VII, though the weak cropping of the last named makes it of doubtful value, and dessert, Cox's Orange Pippin, Worcester Pearmain, Miller's Seedling, Laxton's Superb, Ellison's Orange and Lord Lambourne. Planting and soil management and the effects of nutritional research work on manuring are discussed. A note is included on humus with mention of the Indore method and the Adco process. As regards pruning the author contents himself with pointing out that different methods are adopted for different purposes and with different results. He gives numerous examples and refers the reader for detailed information to the Ministry's *Advisory Leaflet 117*. For advice on spraying the reader is also referred to the Ministry's various leaflets and to *Bulletin 5* entitled "Commercial fruit tree spraying and what it costs." Brief notes are given on the treatment of neglected or old orchards, on storage, and on the finance of apple growing.

634.1/2

346. TAYLOR, H. V., AND JOHNSTONE, K. H. 635.9  
**Commercial flower production. II. Summer flowers. III. Foliage.**  
*Bull. Minist. Agric. Lond.* 109 and 110, 1938, pp. 61 and 55, 1s. 6d. and 1s.  
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350. HORTICULTURAL EDUCATION ASSOCIATION. 634/5  
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information relating to fungicides and spraying equipment. Over 200 pages are then given to descriptions, arranged under host plants, of the diseases affecting all the fruits commercially grown in this country, followed by 23 pages on diseases of hops. Non-parasitic disorders are included together with those caused by viruses, bacteria and fungi. Emphasis is placed on the diseases, not on the parasites, and the descriptions of pathogenic organisms are reduced to a minimum. The symptoms on each plant are classified into those affecting roots, stems, shoots, leaves, flowers and fruit respectively. The final chapter notes certain important diseases prevalent overseas, but not yet recorded in Britain. In setting forth such material, two difficulties inevitably arise—certain diseases affect a wide range of fruits, and certain diseases may each attack more than one part of the host. Dr. Wormald has met the first difficulty by including in his third chapter the omnivorous parasites like *Armillaria mellea* and *Bacterium tumefaciens*, giving cross references under the appropriate hosts. The diseases which attack, for example, shoots, leaves and fruits are dealt with piecemeal under the appropriate headings, a method which has its disadvantages. Dr. Wormald's reputation makes it unnecessary to call attention to the accuracy, clarity and completeness of his descriptions. Particularly welcome are the up-to-date reviews of the present knowledge of bacterial diseases, the brown rot fungi, raspberry diseases and the troubles of the strawberry. Here one realizes how much information on these subjects has been gained by the work of Dr. Wormald himself and his colleagues at East Malling. Furthermore it is refreshing, in a book on plant diseases, to see recommendations of control measures which are in accordance with modern practice. The value of the book is materially increased by a series of forty plates providing the finest album of plant disease photographs ever published in this country. These illustrations merit more frequent reference than they receive in the text. Dr. Wormald, in his preface, states that the book is written mainly for the grower, and his presentation of the facts, with a minimum of technicalities, makes a volume that is eminently readable. It is the more to be regretted that a price of 17s. 6d. will debar the great majority of growers from reading it. May one hope that Dr. Wormald's book will be widely distributed among all those who have dealings with growers, so that his information may at least reach them second-hand?

R.W.M.

## HORTICULTURAL ABSTRACTS.

VOL. IX.

MARCH, 1939.

No. 1.

Initialled abstracts in the present number are by R. W. Marsh, Long Ashton Research Station, J. Scholz of the State Institute of Horticultural Research, Průhonice, Prague, and by M. E. King and H. L. Pearse of the East Malling Research Station.

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## Horticultural Abstracts

Vol. IX

March, 1939

No. 1

## MISCELLANEOUS.

*Growth promoting substances.\**

1. SÖDING, H. 577.15.04  
 Die Wuchsstofftheorie in der angewandten Botanik. (The theory of growth  
 substances in applied botany.)  
*Angew. Bot.*, 1938, 20 : 407-11, bibl. 19.

Plant hormones are known to be all important for plant growth. It has lately been shown that a whole series of chemical compounds which are more easily obtained has the same effect, the most important being  $\beta$ -indoleacetic acid or heteroauxin, indole-3-butyric acid and  $\alpha$ -naphthalene acetic acid. These are best applied as the K or Na salt in water solution or paste. One of the interesting indications given by investigation on the effect of these products is that the so-called root growth substance is not the only hormone necessary to induce rooting. Yeast extract can also help rooting, possibly by means of the biotin in it. It would appear that no attempt as yet has been made to discover whether the further addition of yeast extract would induce rooting in those cuttings to which other growth substances have been applied in vain. Experiments on this point would be very valuable. It may be noted that the effect of yeast extract may not be due entirely to biotin and also that there are different strains of yeasts all of which should be tried. Growth substances have been used not only to induce rooting in cuttings, but for other purposes also. Thus a certain amount of success has attended their use in grafting, e.g. Müller-Stoll successfully treated vine grafts with 0.05% heteroauxin solution. Amlong and Naundorf have used them to induce early growth in lilac. Again Shibuya broke the dormancy in groundnut seed by applying growth substance to the wounded radicle and Amlong and Naundorf have induced increased germination capacity and strength in old stored seed or seed reluctant to germinate by immersion for 24 hours in 0.01 or 0.001 N heteroauxin solution. The most surprising feature in this last experiment was that the plants which developed from the treated seed grew larger and more strongly than the controls. This also happened in the case of fresh seed. The differences were large, thus treated radish seed yielded nearly double and treated sugar beet seed yielded over double crops. Thimann and Lane report comparable results with wheat and oats. The primary effect is on the vegetative growth. It seems to be similar to that obtained by transplanting cereals even as regards the initial check noticeable in both cases. On the whole, however, seed treatment needs further investigation as it has not been uniformly successful. A further method of application to the young plant is by spraying or painting on with a fine brush. Or again mere watering with weak solution has been found to increase growth, e.g. as in *Matthiola*. The effect on the actual seed crop has not been determined. Growth substances have been successfully used to induce parthenocarpic fruiting in *Ilex opaca*. Finally Traub has observed that treatment of unripe fruits with weak solutions of growth substance increases their storage life, but that the use of stronger solutions decreases it.

\* See also 45.

344. MINISTRY OF AGRICULTURE, LONDON.

634.1/2

**Tree fruits.***Bull. Minist. Agric. Lond.* 2, 1938, 3rd edition, pp. 115, 2s. 6d.

This bulletin which was last published in 1935, see *H.A.*, 5: 324, has been very thoroughly revised. It forms an almost indispensable guide for the progressive grower and the horticultural advisor. The section on propagation contains the last word on rootstock selection, clear and well illustrated instructions for grafting and budding and a full account of the so-called framework process suitable when a quick change of varieties in an orchard is desired. The new section devoted to management deals very briefly with soil treatment and with pruning. Advice on pruning has been brought into line with the latest observations of research. A short note is given on ringing shy fruit formers. The task of variety selection is made somewhat easier by the elimination of a considerable number of varieties, the tendency nowadays being for large plantings of few varieties. The merits of different apple, pear, plum and damson, cherry, peach, nectarine and cider apple varieties are discussed and a note is given of the national fruit trials at Wisley established to test new varieties against old. In view of this tendency to plant few varieties, the section on pollination is very welcome. In it the problems involved in planting to ensure adequate pollination are discussed and practical advice given on how to solve them. Control of diseases and pests is dealt with concisely but very shortly and for more detailed knowledge the reader is referred to current literature on the subject and to the publications of the English research stations. Short notes are given on the ways in which established orchards can be improved. Since moreover with increased storage facilities the problem of handling fruit has become more urgent, notes are included on the harvesting and storage of fruit and reference is made to the recent advances in gas storage. Finally under marketing the various National Mark Schemes for apples, pears, plums, cherries, cider, perry and fruit products are very briefly outlined.

345. MINISTRY OF AGRICULTURE, LONDON. (TURNBULL, J.)

634.11

**Commercial apple production.***Bull. Minist. Agric. Lond.* 111, 1938, 1st edition, pp. 56, 1s. 6d.

This bulletin deals with the large-scale production of commercial apples in England. The English market now absorbs some 10-12 million cwt. of apples of which in some years more than half are imported. The varieties home produced are mainly culinary, Bramley's Seedling predominating. The chief apple growing areas are Kent, Essex, the West Midlands (mainly Hereford but also parts of Worcester and Gloucester), and the West Country, namely Somerset and Devon (cider apples predominating). Although extremes of sunshine and rainfall are not experienced in England, these two factors probably play an important part in the distribution of apple areas in England. Soil surveys of England have shown that fruit growing appears to fail under only two soil conditions, namely waterlogging or extreme sandiness, the effects of the latter being rectifiable only by large and uneconomic potash manuring. As regards altitude good plantations are found at all altitudes from sea level to above 400 ft. The author's remarks on stocks are somewhat guarded, but it is suggested that according to circumstances the grower may choose seedlings or one of the vegetatively produced stocks such as I, II or IX. Varieties of proved excellence are culinary, Bramley's Seedling, Lord Derby, Grenadier, Arthur Turner and possibly King Edward VII, though the weak cropping of the last named makes it of doubtful value, and dessert, Cox's Orange Pippin, Worcester Pearmain, Miller's Seedling, Laxton's Superb, Ellison's Orange and Lord Lambourne. Planting and soil management and the effects of nutritional research work on manuring are discussed. A note is included on humus with mention of the Indore method and the Adco process. As regards pruning the author contents himself with pointing out that different methods are adopted for different purposes and with different results. He gives numerous examples and refers the reader for detailed information to the Ministry's *Advisory Leaflet 117*. For advice on spraying the reader is also referred to the Ministry's various leaflets and to *Bulletin 5* entitled "Commercial fruit tree spraying and what it costs." Brief notes are given on the treatment of neglected or old orchards, on storage, and on the finance of apple growing.

346. TAYLOR, H. V., AND JOHNSTONE, K. H. 635.9  
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R.W.M.